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FIFTY-EIGHTH YEAR

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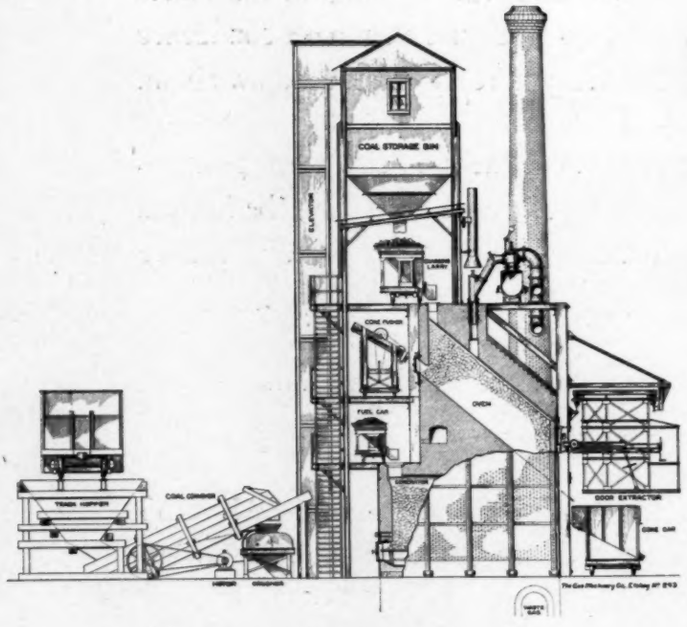

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Modification of Bloch's Method of Calculating Illumination, With Calculations Only Comprehensible to Engineers Eliminated, Can be Made Understandable to Layman

Point-by-Point Method Tedious, and, Unless Supplemented by Complicated Additional Calculations, Suitable Only for Cases in which Illumination is Received Direct from Light Source—Flux Method Simple, but Only Suitable for Calculation of General Illumination in Interiors

By ROBERT FFRENCH PIERCE

There are two methods of calculating illumination in general use at the present time:

> The Point-by-point method, in which the illumination at several points in the illuminated area are separately calculated from distribution curves of the light sources and a table of constants.
>
> The Flux Method in which the average illumination, resulting from the portion of total light generated which reaches the "working plane," is calculated by means of "utilization factors," which express the percentage of total light reaching the working plane with various types of reflectors, and various combinations of light, medium, and dark sidewalks and ceilings, these factors having been obtained by actual measurement in lighted rooms.

Of these methods, the first is tedious and, unless supplemented by complicated additional calculations, suitable only for cases in which all the illumination is received direct from the light source, of which the principal examples are street lighting and interiors lighted by lamps with opaque reflectors. Even in these cases some illumination is contributed by reflection from buildings and sidewalks, though usually neglected in calculations.

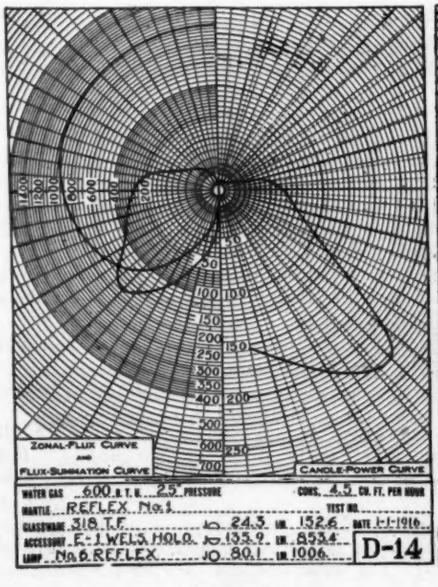
The second method is extremely simple but is only suitable for the calculation of general illumination in interiors.

Variation of Flux Method Developed by Bloch

Bloch has developed a variation of the flux method by which the average illumination from street lighting systems may be easily calculated to a high degree of precision, and by suitable allowances, the method may be extended to the lighting of interiors. Bloch's method, while simple to the engineer, involves certain calculations which are likely to mystify the layman, and it is to eliminate these calculations and make evident the fundamental relations involved that the modification herein described has been devised.

It has been found by Bloch that the average illumination of an area whose length is twice its breadth, having a light source above any portion of it (except near the extreme edges), will be the same as that upon an equal circular area having the light source at an equal elevation directly above its center. If the rectangular area be square, the average illumination will be 10 per cent greater than that upon an equal circular area, while if the rectangular area be three times as long as broad, the illumination will be 10 per cent less than that of the equal circular area.

Bloch's method was to multiply the distance (parallel to the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WATER GAS 600 B.T.U. 25" PRESSURE CONS. 4.5 CU. FT. PER HOUR
MANTLE REFLEX No.1 TEST NO.
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FIGURE II

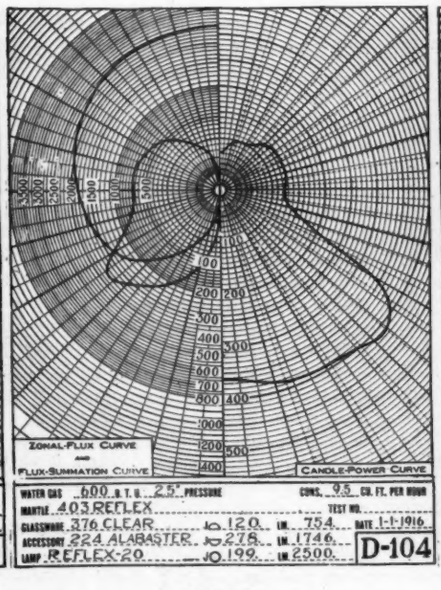
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FIGURE III

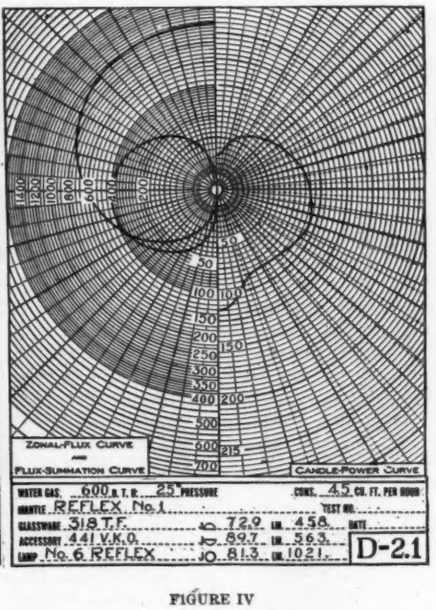
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FIGURE IV

street) between lamps by the width of the street, and ascertain the radius of an equal circular area. From the height of the lamp and a curve showing the quantity of light within various angles the amount falling upon the circular area was calculated, and this quantity divided by the area, gave the average illumination. Bloch found that his method gave results within 5 per cent of those obtained by actual measurement, regardless of the arrangement and spacing of lamps.

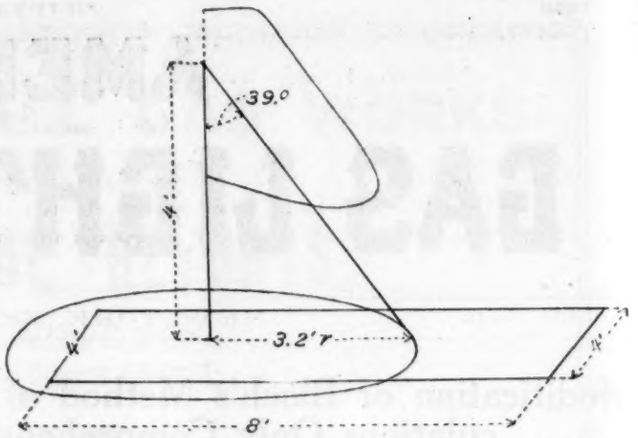
There is a large field for the application of a simplified method of this sort. At present the local illumination of benches, desks, machines, etc., must be laboriously calculated by the point-by-point method, since the flux method is suitable for general illumination only, and perhaps the basic idea of Bloch's method may best be illustrated by reference to an example.

Example Cited

If a lamp be placed 4 ft. above a table 4 ft. x 8 ft. in size, the average illumination, according to Bloch's investigations will be the same as that over a circular area 3.2 ft. in radius (6.4 ft. diameter) directly beneath the lamp, since a circle 6.4 ft. in diameter contains the same area as a rectangle 4 ft. x 8 ft.

All the light from 0 deg. to 39 deg. will fall upon this circular area, but none of the light above 39 deg. The calculation of the average illumination therefore involves only the determination of the quantity of light within the angle of 39 deg., and its division by the area of the circle (32 sq. ft.).

The quantity of light within this angle cannot be read from the ordinary distribution curve, as this curve gives only the intensity at different angles in a single vertical plane—a slice through the emitted light, so to speak.



ALL LIGHT FROM 0 TO 39 DEGREES FALLS UPON CIRCULAR AREA

If we plot a flux distribution curve, every point of which represents the total quantity of light out to the designated angle, the desired quantity may be read direct from the curve. The large curve on the left hand side of Fig. II is such a curve and its values are read from the horizontal scale.

At 39 deg. we read 360, the total amount of light (in lumens) out to and including 39 deg. This is the quantity of light falling upon the circular area containing 32 sq. ft. The average illumination therefore is $\frac{360}{32}=11.9$ lumens per sq. ft. or foot candles, and this is the average illumination (within 5 per cent upon the 4 ft. x 8 ft. table. If the table were 3 1/3 x 10 ft. (three times as long as broad, and containing practically the same area) the average illumination would be 10 per cent less or (11.9—1.19) =10.7 about), while if square and 5 2/3 ft. on each side, the illumination would be 10 per cent more or (11.9 plus 1.19)=13.1 approximately.

In order to eliminate calculations of equivalent circular areas and corresponding angles, Table 1 has been prepared. From this table the angles corresponding to any area and height may be obtained to a degree of precision suitable for any practical problem.

The solution of a typical problem follows:

Required: The average illumination on a bench 3 ft. x 20 ft., lighted by 3 No. 1 Reflex lamps with Welsbach-Holophane reflectors 3 ft. above the bench.

The area per lamp is $\frac{20 \times 3}{3}=20$ sq. ft.

The angle corresponding to an area of 20 sq. ft. and a height of 2 ft. is 40 deg. The quantity of light within 52 deg. is 520 lumens and the illumination is $\frac{560}{20}=28$ lumens per sq. ft.

or 28 foot candles.

	1	2	3	4	5	8	10	15	20	25	30	40	50	60	70	80	90	100	125	150	175	200	250	300	350	400	500	600
1	30	39	44	48	54	58	61	65	68	70	72	74	76	77	78	79	80	80	81	82	83	83	84	84	85	85	85	85
2	16	22	26	30	35	39	42	47	52	55	57	61	63	65	67	68	70	70	72	74	75	76	77	79	80	80	81	82
3	11	15	18	20	25	28	31	37	40	43	46	50	53	56	58	59	61	62	65	67	69	69	71	73	74	75	77	78
4	8	11	14	16	19	22	24	29	32	35	38	41	45	48	50	51	54	55	58	60	62	64	66	68	69	70	72	74
5	7	9	11	13	15	18	20	24	27	30	32	35	39	41	43	45	48	49	52	54	56	58	61	63	65	66	68	70
6	6	8	9	11	13	15	17	20	23	25	27	31	34	36	39	40	42	43	46	49	51	53	56	58	60	62	65	67
7	5	7	8	9	11	13	14	17	20	22	24	27	30	32	34	36	38	39	42	45	47	49	52	55	56	58	61	63
8		6	7	8	10	11	13	15	17	20	21	24	26	29	31	32	34	36	38	41	43	45	48	51	53	55	58	60
9		5	6	7	9	10	11	13	16	17	19	22	24	26	28	30	31	32	35	38	40	42	45	48	50	51	54	57
10		5	6	7	8	9	10	11	14	16	17	20	22	24	25	27	29	30	33	35	37	39	42	45	47	48	52	54
12			5	6	7	8	9	10	12	13	15	17	19	20	21	23	25	25	28	30	32	34	37	39	42	43	46	49
14				5	6	7	7	8	10	12	13	14	16	17	19	20	21	22	24	26	28	30	33	35	37	39	42	45
16					5	6	6	7	9	10	11	12	14	15	16	17	19	20	22	23	24	26	29	30	33	35	39	40
18					5	5	5	6	8	9	10	11	12	14	15	16	17	17	19	21	22	24	26	28	30	32	35	38
20						5	5	6	7	8	9	10	11	12	13	14	15	16	18	19	20	22	24	26	28	30	32	35
22								5	6	7	8	9	10	11	12	13	14	14	16	17	19	20	22	24	25	27	30	32
24								5	6	7	7	8	9	10	11	12	13	13	15	16	17	18	20	22	24	25	28	30
26								5	6	6	7	8	9	9	10	11	12	12	14	15	16	17	19	21	22	23	26	28
28									5	6	7	7	8	9	10	10	11	11	13	14	15	16	18	19	21	22	24	26
30									5	6	6	7	8	8	9	9	10	11	12	13	14	15	17	18	19	20	23	25
35										5	5	6	7	7	8	8	9	9	10	11	12	13	14	16	17	18	20	22
40											5	5	6	6	7	7	8	8	9	10	11	11	13	14	15	16	18	19
45												5	5	6	6	6	7	7	8	9	9	10	11	12	13	14	16	17
50													5	5	6	6	6	6	7	8	8	9	10	11	12	13	14	15

UNITS ON TOP FROM RIGHT TO LEFT INDICATE AREA—THOSE TO LEFT, READING FROM TOP TO BOTTOM SIGNIFY HEIGHTS

Method

The above method may also easily be applied to the direct lighting of rooms by adding from 30 to 50 per cent to allow for reflection from walls, according to color, for globes giving considerable intensities at and near the horizontal (such as opaline ball globes, etc.). An example follows:

Required: The average illumination in a room 12 ft. x 12 ft. from a No. 1 Reflex lamp with No. 441 Opaline globe 5 ft. above the working plane. Walls light.

The angle corresponding to an area of 144 sq. ft. and a height of 5 ft. is 56 deg. (Fig. IV) is 295 lumens. $\frac{295}{144}=2.05$ foot candles.

Adding 10 per cent for square rectangle gives 2.2, and an additional 50 per cent for light walls gives 3.3 foot-candles. For medium walls the last addition would be 30 per cent, giving 2.86 foot-candles.

Not the least advantage of this method of calculation is the fact that it is based upon the relation of quantities, the nature of which is easily grasped. For certain classes of work for which no other method is simple and convenient it offers a considerable saving in time and labor.

Difficulty of Obtaining Samples at Reasonable Cost Has Been Serious Drawback to General Adoption of Specification Method for the Purchase of Coal

System of Sampling Devised and Used by U. S. Bureau of Mines Carefully Considered—Coal to Value of over $4,000,000 Purchased Under Specifications by Government Every Year—More than 1,200 Samples Analyzed and Tested in One Month

One of the serious drawbacks to the general adoption of the specification method for the purchase of coal is the difficulty of obtaining at reasonable cost samples of coal that can be considered fairly representative of the commercial product delivered in wagons, railroad cars, or ships.

The purchase of coal by the U. S. Government under specifications depending on the heating value of the coal, its content of ash and of moisture, and other considerations, rather than upon the reputation or trade name of the coal, was based on the fuel investigations begun by the technologic branch of the United States Geological Survey in 1904. The plan was first adopted by the Treasury Department in 1906. Since then the plan, variously modified in form, but the same in principle, has been gradually adopted by other departments until, at present, of the coal used by the Government, the total value of which approximates $8,000,000 annually, more than half is purchased under specifications.

Under the authority of acts of Congress making appropriations for analyzing and testing fuels belonging to or for the use of the United States Government, a laboratory is maintained at the headquarters of the Bureau of Mines, Washington, D. C., where samples representing deliveries of coal purchased under specifications for Government use are analyzed and tested.

At this laboratory more than 1,200 samples have been analyzed and tested in one month. With the complete equipment and the efficient force employed, the analytical work has been so perfected that the analyses and heating-value tests of the samples received are as accurate as may be reasonably expected in laboratory work of this nature.

The method of taking and preparing samples for shipment in use by the Government, which is described in this article has been abstracted from *Bulletin 116*, issued by the U. S. Bureau of Mines.

Theory of Sampling

To determine with utmost accuracy the ash content and heating value of a quantity of delivered coal would require the burning of the entire quantity, and special apparatus arranged to measure the total heat liberated, or would require crushing the whole quantity, and reducing it by an elaborate scheme of successive crushings, mixings, and fractional selections to portions weighing approximately 1 gram, the minute quantity which the chemist requires for each determination. Either of these procedures is obviously impracticable if the coal is to be used for the production of heat and power.

The method actually employed is to select portions from all parts of a consignment or delivery of coal, and to systematically reduce the gross sample, obtained by mixing these portions, to quantities that the chemist requires for making ash determinations or that can be burned conveniently in the calorimeter. The gross sample should be so large that the chance admixture of pieces of slate, bone coal, pyrite, or other impurities in an otherwise representative sample will affect but slightly the final results. Increasing the size of the gross sample tends toward accuracy, but the possible increase is limited by the cost of collection and reduction. In reducing the gross sample by successive crushings and halvings or fractional selections, the object is to procure a small laboratory sample that, upon analysis, will give approximately the same results as the gross sample itself, or, in fact, the entire quantity of coal from which the gross sample was obtained.

As a sample loses moisture, its B. t. u. "as received" value correspondingly rises, with the result that the price for delivered coal determined on the "as received" value is, with rare exceptions, higher than that warranted by the quality of the coal at the time of weighing. As a general statement, payment based on the "as received" B. t. u. value will be higher than warranted, unless the sampling and laboratory work can be carried on under conditions that minimize moisture loss, as under freezing temperatures.

Recognizing the uncertainty involved in taking the moisture determination in the laboratory as representative of the moisture content of the delivered coal and the consequent possibility of payment of a higher price than is warranted, the Bureau of Mines recommends that the heating value in coal specifications be on the "dry-coal" basis.

The fact is recognized that the amount of moisture contained in coal produced from day to day from the same mine, or group of mines working the same bed, is largely accidental, and is a matter over which the buyer and seller have only slight control. However, in order to place a negative value on high-moisture coals and to protect the Government against the delivery of coals containing excessive amounts of moisture, the specifications require the bidders to specify the maximum moisture content in coal offered. This value becomes the standard of the contract.

If coal of uniform B. t. u. "dry-coal" value is delivered on a contract, the contractor receives the advantage on any delivery in which the moisture content approaches the maximum specified, because he is paid for the weight of water contained in the coal in excess of a normal amount, whereas if the coal is very dry, containing less than the normal amount of moisture, the purchaser receives the advantage.

The determination of the moisture in coal delivered from stock piles is often of great importance, for the proportion of moisture contained in the small sizes, which are most abundant near the center of a stock pile and which absorb the rains, and melting snows in districts of heavy snows, may be from 10 to 15 per cent higher than when stocked.

Ash and Heating Value

The heating value of coal from the same mine or from a group of mines operating the same bed of uniform character is directly influenced by the percentage of ash. By ash is meant earthy matter and impurities that do not burn. As the proportion of ash inherent in the coal substance as a rule does not vary widely in coal from the same bed, the heating value is largely determined by the amount and character of the free (sometimes termed "extraneous") impurities, and hence the manner in which coal is cleaned and prepared at the mine may greatly effect the heating value of commercial shipments. In collecting samples, therefore, it is of utmost importance that the samples should contain within reasonable limits the same proportion of impurities as the delivered coal from which they were taken.

As the specifications provide for adjustment of price according to the ash content, or the heating value, or both, it is evident that samples taken from delivered coal should show, by analysis, practically the same ash content and heating value as the delivered coal. In other words, the samples should contain the same proportion of slate, bony coal, pyrite and other impurities as the quantity delivered, in order that the price adjustment based on the analysis may be fair to both purchaser and seller. Obviously, it is important to guard against any accidental admixture of sand, cement, clinkers, or other foreign matter while the sample is in storage or while it is being prepared for transmittal.

In this connection, attention is called to the fact that the gross sample should contain the same proportion of lump and fine coal as the delivered coal, for it has been determined that fine or slack coal may have an ash content, or a heating value, different from lump coal from the same shipment.

Volatile Matter

The volatile matter of coal, as shown in analyses, generally contains some inert noncombustible matter, the proportion of which may range from 1 to 15 per cent. The character of the volatile matter in any given coal, and the temperatures at which it is given off, bear directly on the design and operation of furnaces for burning the coal efficiently and without smoke. The proportion of combustible and noncombustible constituents in the volatile matter and the character of the combustible constituents differ in different coals, and, therefore, the heating value of a coal can not be determined from a proximate analysis. Moreover, different coals with the same proportion of volatile matter may not behave alike in the furnace. In order to determine the comparative value of two coals for the same purpose, it is important to know both their chemical composition and their heating value.

Sulphur and Clinker

Sulphur is commonly present in coal in combination with iron or other elements. For a long time it was thought that the sulphur formed clinker, but recent investigations point to the fact that sulphur is not the only cause of clinkering; in fact, there may be no difficulty from clinker in burning coal containing as much as 5 per cent or more sulphur. The relative proportions of iron, sulphur, lime, alumina, silica, etc., in the ash effect its fusibility, whereas the method of firing and the rate of combustion are important factors in the formation of clinkers. The exact relation of clinkering to the constituents of the ash is not known so well that one can definitely predict from an analysis of the ash whether a coal will or will not clinker. At many power plants the fireman slices the fire too often and works the ash up from the grates into the hot coal bed, where it melts and fuses into heavy, dense masses of clinker. At high rates of combustion the ash in a given coal may clinker (though at lower rates it does not) because of the ash being raised to the fusing temperature. The fact that the percentage of sulphur does not necessarily indicate the behavior of the coal in the furnace is recognized in the specifications recommended by the Bureau of Mines.

Need of Experience and Caution in Sampling

Persons without experience generally select a sample better than the average run of the coal delivered. Occasionally, a lump unusually free from layers of slate and impurities, and representing the best coal in the lot rather than the average, is selected. After being broken it is shipped to the laboratory in a cloth sack, so that it loses moisture during transit.

The analysis of such a sample necessarily indicates a value higher than that of the coal delivered. As a quantity of coal may vary greatly in composition, containing not only what may be termed coal proper, with certain more or less constant impurities, but also slate, pyrite, and bony coal, a lump may be anything from almost pure coal to material without fuel value. Hence the analysis and test of a single lump may indicate a composition greatly different from that of the coal at hand. It is well to remember that, as the larger lumps of coal roll down and collect near the bottom of a pile or load, a sample taken entirely from near the floor does not always fairly represent the whole.

In spite of every precaution taken to prevent loss of moisture during the collection, preparation, and analysis of samples, it is certain that loss of moisture may occur; also there may be too little or too much slate, bony coal, or other foreign matter collected in what is otherwise a truly representative gross sample, so that the determination of the heating value or ash content does not strictly agree with the actual value of these factors in the coal delivered. However, an experienced collector, by using good judgment and following the general directions given for collecting and preparing samples, can obtain samples so fairly representative that the results of the analyses are reasonably accurate. The suggestions that follow are presented for the guidance of those who wish to send representative samples to a laboratory for analysis and heating-value tests.

Directions for Sampling

The number of pounds to be taken as a gross sample to represent a given lot of coal varies with the character and condition of the coal, and not with the amount of coal to be sampled. The character and proportion of the bony coal, slate, etc., and the size of the particles of both coal and impurities are the governing factors. It is therefore evident that sampling should not be left to an inexperienced person, but should be done by one who is thoroughly familiar with the significance of these factors, and has some knowledge of the coal to be sampled.

There is greater probability of taking too little than of taking too much coal for a gross sample. It is generally true that the larger the gross sample the less is the chance of its being nonrepresentative. Large samples must be taken in sampling coals that carry a varying proportion of large pieces of slate, bony coal, or pyrite, for it is evident that including or excluding large pieces of the impurities must affect the analysis of a small sample considerably; hence, the analysis may not indicate the quality of the coal sampled and, consequently, may be worthless for determining the price to be paid for the coal. If the free impurities are small particles and are well distributed throughout the coal, representative samples may be obtained easily.

When to Collect Samples

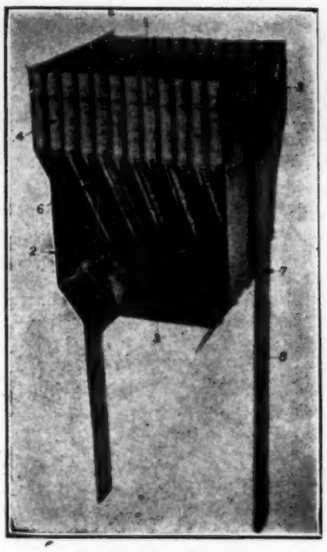
The best opportunities for procuring representative samples are afforded while the coal is being loaded into or unloaded from railroad cars, ships and barges, or while it is being dumped from wagons. Once the coal is stored in piles or bins, or loaded on cars or vessels, the procuring of representative samples is practically impossible unless the whole quantity of coal is immediately handled again, and the conditions for sampling become favorable. Samples collected from the coal exposed in piles, bins, barges, cars, or ships can be considered representative only under the condition that the mass of coal is homogeneous throughout. Such a condition is highly improbable and uncertain, and the analysis of samples collected from the surface may give results that are very unreliable as indicating the nature of the entire quantity, and that may be worthless as a basis for determining an equitable price to be paid for the coal.

When coal is being loaded into or unloaded from wagons, railroad cars, ships, or barges, a shovel or a specially designed tool may be used for taking portions or increments of 10 to 30 lb. to make up the gross sample. As the size of the increments should be governed by the size and weight of the largest pieces of coal and impurities, increments of more than 30 lb. may be required for coals containing large pieces of coal and impurities.

The mechanical collection of samples is preferred to shovel sampling, as it eliminates the personal equation. The mechanical sampler does not discriminate for or against taking more or less slate or other impurities. A person should collect samples with a shovel in the main without regard to impurities, leaving the amount of the impurities included in a sample largely to chance, as it is impossible to rate correctly the proportion of the impurities concealed in the coal, however competent the sampler may be.

A mechanical sampler should preferably take the whole of the stream of coal flowing down the chute a part of the time rather than a part of the stream all the time, because the sizes and character of the pieces of coal and impurities are not apt to be evenly distributed across the stream. Excellent opportunity is afforded for procuring representative samples if the entire consignment of coal is crushed immediately after it is weighed and delivered, for then the samples can be collected from the crushed coal. If the coal is conveyed from the crusher by a conveyor, means can be devised for mechanically and automatically diverting from the conveyor definite portions of coal to make up the gross sample.

The portions should be regularly and systematically collected, so that the entire quantity sampled will be represented proportionately in the gross sample. The interval at which the portions are collected should be regulated so that the gross sample collected will weigh not less than approximately 1,000 lb. If the coal contains an unusual proportion of impurities, such as slate, bony coal, and pyrite, and if the pieces of such impurities are very large, it will be necessary to collect gross samples of even 1,500 lbs., or more, but for slack coal and for small sizes of anthracite, if the impurities are not in abnormal proportion or in pieces larger than about three-quarters of an inch, and are evenly distributed throughout the coal, a gross sample of approximately 600 lb. may prove sufficient. The gross sample should contain the same proportion of lump coal, fine coal, and impurities as the coal delivered. As soon as the portions are collected they should be deposited in a receptacle having a tight-fitting lid provided with a lock.



SAMPLING RIFFLE

Carload Sampling

Samples taken from railroad cars should not be limited to a few shovelfuls of coal procured from the top of a car, for the size of the coal and the proportion of foreign matter may vary from the top to the bottom of the car. The only way to obtain a representative sample is to take a number of shovelfuls or portions of coal from different points in a car, from top to bottom and from end to end, while the coal is being loaded or unloaded.

When a shipment of coal is sampled at the mine, shovelfuls or portions of coal should be taken systematically as the coal is loaded into the railroad car, and with such regularity that the sample will represent the entire carload. The frequency of collecting the portions will depend on the number of cars of coal to be represented by one gross sample. If only one carload is to be sampled, a gross sample of 1,000 lb., or more, should be collected. If two or more cars of coal are to be represented by the sample, proportionate amounts to make up the gross sample should be taken from the coal as it is loaded into each car. The samples should be taken after the coal has been prepared for market; that is, if the coal is passed over picking tables or pickers are employed on the car to remove the impurities from the coal, the samples should be taken only after the coal has had its final preparation.

When coal is being sampled from dump cars, ladlefuls or shovelfuls should be taken from the stream of coal being discharged to the bins or ship. If the discharged coal is immediately crushed the gross sample should preferably be collected after the coal leaves the crusher.

If a number of carloads are delivered on an order or during a short period the preparation of a gross sample of 1,000 lb. or more for each car would involve considerable time, labor, and expense at the delivery point, as well as in the laboratory; in fact, a gross sample for each car would not be required, for if a gross sample is carefully taken and prepared it can well represent a number of cars. If a gross sample is collected to represent two or more cars representative portions of the coal should be taken in equal quantities from each car.

Cargo Sampling

In sampling cargoes, as in sampling carloads, portions of coal should be taken in equal quantities and at frequent and regular intervals so as to represent proportionate parts of the consignment as a whole, either while the coal is being loaded or unloaded. There is no assurance that a sample or a series of samples taken from the top of the cargo represents the cargo as a whole; in fact, it is very doubtful if such samples are ever representative.

Because of the suddenness with which the coal may break through and drop out of the railroad car after the gates are open and because of the momentum of the rapidly falling coal, it may be impossible to collect a satisfactory sample by attempting to catch coal in a shovel or ladle. In such event, it may be necessary to collect shovelfuls of the coal that has overflowed on the pier. If beams 10 to 12 in. wide span the pockets immediately underneath the car, a fairly satisfactory sample can often be collected in shovelfuls from the coal lodging on the beams.

Though the collector may use the shovel or ladle to the best of his ability, these tools may collect portions of coal that do not contain lump coal in the same proportion that exists in the car. Especially may this occur if the coal contains a large proportion of lumps of considerable size. In that event, the collector should collect portions of lumps from time to time and add them to the sample. Necessarily the collector must be relied upon to collect a sample under these conditions that will fairly represent the proportions of lump and slack coal contained in the coal sampled, and it follows that the collector must have experience in sampling and be able to judge the coal and the sample.

In sampling large quantities of coal in a short period, the collector frequently works under disadvantages and has not the opportunity to select more leisurely and methodically portions of coal to make up a gross sample, as he can in sampling wagonload deliveries or in single carloads or barges unloaded by shovel, clam shells, or grab buckets, and this fact should be considered in comparing the result of sampling cargo with wagon or railroad-car deliveries.

MIXING AND REDUCING MACHINE

In collecting samples from coal as it is unloaded from a ship, the same general instructions apply; the cargo being systematically sampled during the entire period of unloading, so that samples will be collected which represent the quantity as a whole. If unloaded by grab buckets or into barrows, shovelfuls should be collected at regular intervals from the buckets or barrows. If the coal is crushed immediately after it is unloaded, it is preferable to collect samples from the crushed coal.

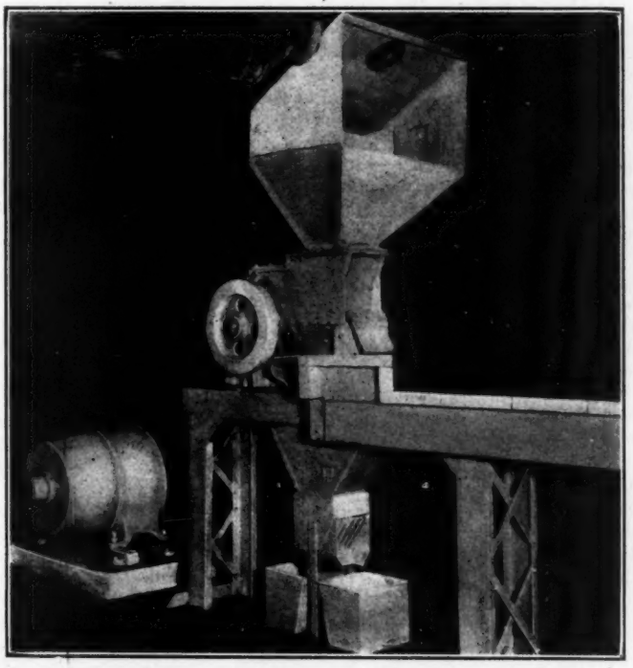
Sample Receptacle

As the wagons or railroad cars may arrive irregularly at the building or plant and the coal be intermittently unloaded, a metal receptacle or wooden box of a size to hold a gross sample of at least 1,000 lb., with a tight-fitting lid which can be locked, is required for holding the portions of coal taken from each wagon or car until the gross sample is completed. In sampling cargo deliveries, buckets holding 60 to 70 lb. may prove more satisfactory to use for receiving the portions making up a gross sample, as the samples are usually worked down as the loading progresses and the buckets are convenient for carrying the coal to the space available for preparing the gross samples. If the gross samples are stored, a box should be provided or else a sufficient number of buckets with tight-fitting lids and locks should be available in order to preserve the integrity of the sample.

The buckets, boxes, or receptacles should be inspected each time before using and thoroughly cleaned to remove the coal dust remaining from previous samples and any foreign matter that may by chance be in them.

Collection of Special Moisture Samples

During the collection of gross samples and their reduction to quantities that are convenient for transmittal to the laboratory, and



TYPE OF COAL SAMPLING PLANT USED BY GOVERNMENT

that correctly represent the ash, sulphur, and heating value of the coal sampled, it is ordinarily impossible to retain in the sample all the moisture that was in the delivered coal. Obviously, if it is desired to determine the amount of moisture in delivered coal, special moisture samples are usually necessary. Owing to the fact that a sample unavoidably loses moisture during every stage of handling and preparation, the special moisture samples must be, in a sense, grab samples and must be collected, prepared, and placed in a sealed container with as little delay as possible.

If a gross sample is collected during a period of a few hours or a very few days and the sample is collected and stored under conditions that will preserve its moisture content, a special moisture sample may be collected from the gross sample after it has been rapidly crushed, so that it will all pass through a 1-in. screen (the fineness to which the gross sample is reduced by the first crushing.) It should be collected in a place comparatively cool and protected from rain, snow, wind, and the sun's rays. A small scoop may be used for collecting the sample. The scoop should have a capacity of about 1 lb. of coal—a scoop with bottom about 2½ in. wide and 8½ in. long and vertical sides about 2 in. high is about the right size. As the crushed coal is shoveled into a conical pile, scoopfuls should be regularly and systematically collected so that approximately one scoopful will be collected to every two shovelfuls (about 30 lb.) deposited on the cone, thereby collecting a special moisture sample weighing from 30 to 50 lb. As the scoopfuls are collected they should be placed in a receptacle which can be tightly closed. After the gross sample has been formed into a conical pile, and the special moisture sample weighing 30 to 50 lb. has been accumulated, the special moisture sample should be immediately and rapidly crushed so that no pieces of coal or impurities are larger than one-half inch; and it should be rapidly coned, flattened, and quartered, and a mailing can filled by taking portions from each quarter by use of the scoop (each portion only partly filling the scoop). The mailing can should be properly sealed at once and forwarded to the laboratory.

If the gross sample in the above case is crushed mechanically and reduced to the quantity desired for transmittal to the laboratory by use of sampling machines in such a manner and in machines so designed that moisture losses are minimized, then the collection of a special moisture sample may prove unnecessary, as the moisture determination made on the regular sample will represent, within reasonable limits, the moisture content in the coal delivered.

If a gross sample is collected during a period of several days, and if it is manifest that the sample will lose moisture during its storage and preparation, the special moisture sample should be accumulated by placing in a receptacle small portions of the freshly taken increments making up the gross sample. Under these conditions it is desirable that a receptacle which can be hermetically sealed and has a capacity of about 100 lb. be provided, in which to preserve the portions making up the special moisture sample as they are taken each day. After the gross sample is accumulated a quantity convenient for transmittal to the laboratory should be selected from the special moisture sample (in accordance with the method given above) and forwarded in the mailing can, properly sealed for special moisture determination.

If two or more railroad cars are to be represented by one gross sample, and if the cars contain different amounts of moisture seemingly in excess of the maximum moisture content guaranteed, moisture samples should be taken separately from each car. If a single gross sample is to represent several days' delivery, and if because of heavy intermittent rains there is a considerable difference in moisture content between each day's delivery, and each contains moisture in excess of the maximum content guaranteed, then a special moisture sample should be taken representing each day's delivery. Payment for the entire quantity on account of ash and B. t. u., "dry coal," is determined from the analysis of the gross sample, but corrections on account of excessive moisture should apply to the particular car or cars, or day's delivery. The purchaser would be at a disadvantage on account of heavy rain if corrections for moisture did not apply to each day's delivery or fraction of the delivery, because if the special moisture samples were mixed, and one special moisture determination only made, the effect of the heavy rains would largely be averaged out in the mixture, and, in addition, in storing, mixing, and reducing the samples there would be more or less moisture lost.

Preparation of the Gross Sample

Though a gross sample may be collected ever so carefully and may represent the coal sampled, unless it is prepared in accordance with well recognized principles, the results of analysis and test may be worthless for determining equitable settlement for the coal.

The portions taken in making up the gross sample should be immediately placed in a box or a receptacle having a tight-fitting cover and a lock, for storage in order to preserve its integrity until it is reduced to a quantity convenient for transmitting to the laboratory.

If it is desired to determine the moisture content of a gross sample that has been collected in a comparatively short time under precautions to minimize moisture loss, the sample should be placed in a comparatively cool place and the crushing, mixing, and reduction for shipment to the laboratory should be done as rapidly as possible; this is imperative if the analysis of the sample is to represent the approximate condition of the coal with respect to its moisture content at the time it was weighed. Obviously, a sample on which a moisture determination is desired should be protected from rain and snow and strong air currents or winds and the sun's rays during its storage and preparation.

The proper preparation of a gross sample for shipment to the laboratory involves three operations: (1) Crushing, (2) mixing, and (3) reduction in quantity. The operations proceed in stages until the final sample is obtained.

Crushing May Be Done By Mechanical Crusher

The crushing may be done by a mechanical crusher or by hand with an iron tamping bar or sledge on a smooth, clean, sheet-iron plate, of suitable dimensions, or on a solid floor—in the absence of a sheet-iron plate or smooth, tight floor, the crushing may be done on a heavy canvas—to prevent the accidental admixture of any foreign matter. The mixing and reduction may be done by hand with a shovel, or mechanically by means of riffles or sampling machines.

It is obvious that if the gross sample is reduced in quantity without crushing, the effect of the selection or rejection of one or more of the large pieces of slate or other impurities in the portion of the sample retained multiplies rapidly as the sample becomes smaller.

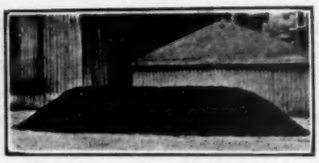
Care should be exercised to crush finely pieces of foreign matter before each reduction so that the crushed impurities can be distributed through the sample, and when crushing to keep pieces of slate and other impurities from flying out of the sample. In crushing the coal on wood, brick, cement, or on floors of such materials, splinters or small fragments may be broken from the floor and be mixed with the sample. Such floors, if used, should be thoroughly clean and free from cracks. If a sheet-iron plate is used, it should be free from rust.

Method of Mixing Before Reduction in Quantity

After each crushing the sample should be thoroughly mixed before reduction in quantity. The method which gives generally satisfactory results is as follows:

The crushed coal is formed into a conical pile by depositing each shovelful of coal on top of the preceding one. As the shovelfuls are deposited the fine material forms the apex of the cone, while the coarse particles roll down toward the base. By walking around the cone and systematically depositing shovelfuls on the apex of the cone from every side, care being taken to maintain the original form, the sampler will properly distribute the fine and coarse coal. A new, long pile is then formed by taking a shovelful at a time and spreading it out in a straight line or ribbon the width of the shovel; the length is 5 to 10 ft. for a shovel holding about 15 lb. Each new shovelful is spread over the top of the preceding one, beginning at opposite ends, and so on until all the coal has been formed into one long pile. The sample is then halved in quantity by shoveling the long pile to one side, alternate shovelfuls being discarded while the retained shovelfuls are formed into a new cone. In shoveling the coal from the long pile the sampler takes the shovelfuls of coal systematically around the pile, advancing at each shovelful a distance about equal to the width of the shovel, thereby preserving the symmetry of the form of the pile. If the pile should be reduced by shoveling all of the coal from either end, and if the alternate shovelfuls discarded contained coal mainly from the sides of the pile, the rejected half of the sample would contain a preponderance of coarse coal, while the retained half would contain relatively too much fine coal. This is because the coarse coal rolls

CRUSHED SAMPLE IN CONICAL PILE



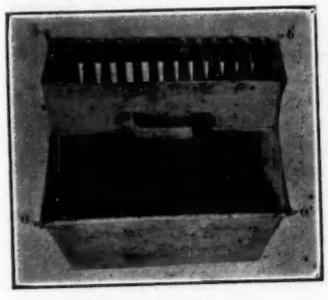
REMIXED IN LONG PILE

down the sides of a pile or cone while the fine coal builds up, so that the relative proportions of coarse and fine coal in outer and inner portions of the pile are quite different. The alternate shovelfuls of coal which are retained are formed into a new cone.

In coning, care should be observed to deposit each shovelful so that the center of the cone as started will not be drawn to one side, for in quartering a cone the center of which has been drawn, two opposite quarters will contain an excess ratio of fine material, while the other two quarters will contain a deficiency. This will be apparent when it is considered that when a cone is formed, the fines build up the apex while the coarse particles roll down the sides.

Quartering Method Used to Still Further Reduce Sample

After the gross sample has been reduced by the coning, long-pile, and alternate shovel methods to approximately 250 lb. the sample is further reduced in quantity by the quartering method. Before each quartering, the sample is thoroughly mixed and made into a conical pile, as follows:



SAMPLING BUCKET

Quantities of 125 to 250 lb. are shoveled into a new conical pile by depositing each shovelful of coal on top of the preceding one; quantities less than 125 lb. are placed on a suitable cloth, measuring about 6 by 8 ft., and mixed by raising first one end of the cloth and then the other, rolling the coal back ad forth. After the coal is thoroughly mixed it is formed into a conical pile by gathering together the four corners of the cloth. The conical pile is quartered as follows:

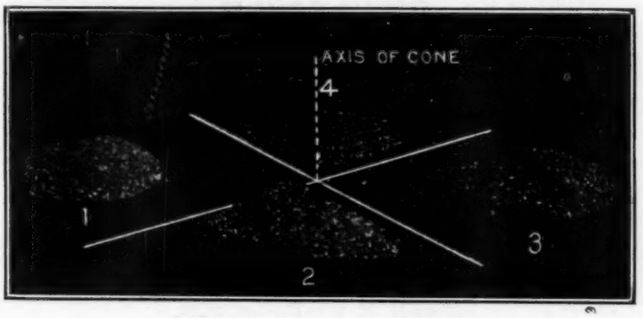
The cone is flattened, its apex being vertically pressed down with a shovel or a board, so that each quarter contains the material originally in it. The flattened mass, which should be of uniform thickness and diameter, is then marked off into quarters with a board held edgewise, or a piece of sheet iron, along two lines that intersect at right angles directly under the apex of the original cone. The diagonally opposite quarters are shoveled away and discarded, and the spaces which they occupied brushed clean. The coal remaining is successively mixed, coned, and quartered on the canvas until two opposite quarters are about equal to the quantity (approximately 5 lb.) required to fill the sample container for shipment to the laboratory. If after two opposite quarters are placed in the sampling container, it is found that the container is not compactly filled, the other two quarters should be mixed, coned, flattened, and quartered, and the remaining space in the container then filled by taking equal segments from opposite quarters, using the sampling scoop. The two rejected quarters are not thrown into the discard, but are placed in a sampling container, hermetically sealed, and held in reserve at the delivery point until report of analysis of the regular sample is received and settlement made for the coal.

Thorough Cleanliness Must Be Maintained During Entire Operation

Accuracy in reducing the gross samples requires that the coal be crushed as directed, thoroughly and systematically mixed, formed in piles, and accurately divided, either by the alternate-shovel method or by quartering, so that the rejected portions and the retained portions will be uniform in character and weight. Thorough cleanliness must be maintained during the entire operation.

Whenever the different increments of samples are collected throughout some considerable period of time, each increment may be crushed as soon as taken, and the pieces of coal and impurities may be broken sufficiently small to permit two or more reductions of the accumulated samples before further crushing is necessary.

If deliveries extend over a considerable period, what would otherwise be a gross sample may be worked down, as it accumulates, in successive stages to quantities of a size suitable for transmittal to the laboratory, and these fractional samples may be analyzed and the several analyses averaged, or they may later be mixed (at the delivery point or in the laboratory and reduced to one sample) and one analysis made. In averaging analyses or in mixing the several samples, weights should be used in proportion to the tonnages that the fractional samples represent.



REDUCED SAMPLE QUARTERED

If the contract amounts to a considerable quantity, necessitating several samples in relatively short periods, the installation of a crusher has been found in some cases expedient and economical for reducing the gross samples to three-sixteenths inch mesh, or finer, and in such case, instead of the mixing and reducing being done by hand, the reducing buckets or mixing and reducing machine are used. Even though the contracts are relatively small and the samples are crushed by hand, the use of the reducing bucket or machine is recommended. These devices are generally used after the gross sample has been mixed and has been reduced by the "alternate shovel" and quartering method to about 60 lb.

Mechanical Crusher and Mechanical Means for Preparing the Sample for Transmittal to Laboratory

The quartering method is used after the sample has been reduced by alternate shovels to approximately 250 lb., as the capacity of an ordinary shovel is out of proportion to the size of the sample. It may prove desirable in sampling coal containing considerable quantities of free impurities of uneven size to use small shovels of 10 lb. and less capacity in reducing the gross sample by alternate shovels, for as the size of the shovel is diminished the number of fractional parts into which the sample is divided is increased. As the sample becomes smaller, greater precision in quartering is required, and, consequently, refinements in the manner of mixing and reducing should be introduced. The use of buckets or the machine makes thorough mixing possible and the riffles insure accurate division.

A mechanical crusher and mechanical means for preparing the samples for transmittal to the laboratory may be installed and the collection and preparation of the sample can then be made a continuous and purely mechanical process. When mechanical crushers are used the sample should be inspected before or while being fed to the crusher to make certain that the sample does not by chance contain a piece of iron, such as a tie spike or some other highly abrasive substance, accidentally loaded with the coal in the mine and undetected in collecting the sample, otherwise the abrasion of the iron may introduce errors which would alter appreciably the final results.

Hurricane Possibility Considered in the Design of Porto Rico Gas Holders

In connection with the gas holders of the Porto Rico Gas Companies, which, as was noted on page 149 of last week's issue of the American Gas Light Journal, though subjected to a hurricane for more than four hours, sustained no damage, it is interesting to note that the possibility of hurricanes was considered in the design of structures. The San Juan holder, on which the pressure record reproduced was taken, has a capacity of 500,000 cu. ft.

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Free Maintenance of Gas Fixtures

In a paper presented at a recent association meeting, a speaker suggested free maintenance of gas lighting fixtures as a means of competing with electricity in the lighting field. This journal understands that the suggestion gave rise to considerable adverse criticism. This does not seem quite called for. It resembles in a way the, fortunately, bygone antagonism of some gas companies to the gas saving mantle lamp. Such a service would be in true accord with modern efficient business methods, which do not stop at a sale, but regard it as but a step in popularizing a certain product, and in promoting future sales.

The advantages of free maintenance are many. In the first place it takes the care of the fixture out of the hands of the layman, who knows practically nothing of its design or construction, and who has no great reason for having an interest in its successful performance, and places it in the hands of a skilled mechanic. From the standpoint of publicity alone this is an advantage of vast importance to the gas company.

Many gas lamps are used in the store windows of small shops. Few of them are good advertisements for gas. A large number of them are of the original upright mantle type with cracked, smoke grimed or tilted chimneys, broken reflectors and corroded piping, and mantles that have for many weeks outlived their efficiency. One somehow instinctively associates gas lighting with shoddy shops. If the gas company were maintaining the fixtures all would be different.

Again there are the less public, but none the less potent signboards of the gas company in private dwellings. The general public does not have access to these, but a small part of it visits each of them and in the aggregate the number is large. The electric lights show off to better advantage because the electric company is charging the consumer for the maintenance of his lamps, and the consumer insists upon getting the quality of lamps he is paying for. If the electric globe grows dim, the electric lighting company will have its attention called to it very promptly. Good lamps mean no additional cost to the consumer. Consequently he is going to insist upon the company's furnishing them. A new mantle on the other hand is a different proposition. It means cash out of the pocket.

It is human nature to want prices in the lump. When we buy a pair of shoes we ask what they cost ready to place on the feet, and for use at the time of purchase. We do not begrudge the proportion of selling expense, of cost of the leather, the metal and the laces. We leave that to the seller. Likewise with a house, telephone service, etc. We desire to know what a thing will cost us without the necessity of going through a series of mathematical contortion with every purchase we make.

The objection may be advanced that most gas companies are selling their product at a certain set figure, and that they would not be permitted to raise that figure were they to include the maintenance of fixtures; that is that the service would mean additional cost without a compensating remuneration.

The rates in operation with most companies whose charges have been fixed by some commission are based upon a certain return on an investment of so much money. Quite often they represent nothing of the kind, but this is due to the incompetence of the membership of the commission at fault, and is aside from the question. It is certain that the company whose rate has been fixed at say a dollar a thousand cubic feet on the basis of an eight per cent return on its investment, is not going to content itself with that eight per cent return.

By the installation of improved machinery, by increased efficiency in organization or by other means it is going to endeavor to increase the proportion of profit. Sooner or later there is going to come a new rate reduction clamor, and the rates are going down again. Such is the premium that is generally placed upon efficient management. If, in the meantime, a maintenance service had been introduced, the cost of that service would be included in the cost estimate preparatory to the rate adjustment. Thus the increased cost without remunerating compensation to the companies would be but temporary. The advantages gained by it would endure for all time. Gas would deprive its most formidable competitor of the greatest of all the advantages it possesses over it under present-day conditions.

More About Writing

"The desire to express is founded on the desire to impress. The writer wants to be read. Moreover, only as it fronts him on the printed page can the writer justly estimate the effectiveness of his work," Professor David Lambuth, of Dartmouth College, has stated.

On this theory he has attracted wide attention in the educational world as a result of his phenomenal success in teaching English to college students, and in conducting a student magazine.

He has collected evidence to prove that young men cannot be expected to write unless there is a strong likelihood that their writings will be printed. Otherwise, they are too prone to consider that the time spent in writing is just so much time wasted. Unless young men do write, many excellent ideas are bound to lie dormant and never be of service to any one. The object then is to persuade these men to write.

In the gas industry there is possibly a greater opportunity to have one's writings published than there is in any other industry. The industry is well provided with trade and technical journals, many large companies have house organs, in which they publish some of the efforts of their employees, and some companies have clubs at which different employees present papers. These papers are afterwards published in bulletins or the technical press. The only thing necessary appears to be to persuade them to write, which is apparently a very difficult matter.

Combination Plants

A farmer had a yoke of oxen and a very high-spirited horse. He used the oxen for the heavy work around the farm and the horse for driving to town. One spring, one of the oxen died. There was a great deal of work to be done and no teams to be secured. The farmer decided to try working the ox and the horse together. He succeeded in getting them hitched up together, but he could not accomplish much work.

In the public utility business we find a young, rapidly-growing industry and an old industry, growing in a much less spectacular manner. In many communities these two industries are yoked together. The result, apparently, is not always entirely satisfactory to every one concerned. The gas men have a habit of complaining that the electric end of the company is killing the gas business and the electrical man says the combination is holding back the growth of the electrical business.

As a matter of fact there is probably not nearly as much basis of fact in these statements as the men who make them believe there is. They do go, however, to show what a very serious problem it is to render perfectly satisfactory service when both the gas and the electric supply is under one control and one management.

There is probably no business in which success depends more upon the loyalty of the employees than does the public utility business. A manufacturer can sell all of his product out of town. His customers may never know that his employees are constantly dissatisfied. They may have real cause to complain yet the customer is not affected. In the public utility business, on the other hand, the total output must be sold to the people in the communities where the employees of the companies live. These consumers judge the companies to a very great extent from the ideas given them by the employees. If all the employees are loyal and boost the company there is very little difficulty in building "good will." If the majority of the employees are not loyal and are inclined to "knock" the company there is bound to be trouble sooner or later. What these employees do in a small way the public will eventually take up and do in a big way.

From these facts it is evident that the employees of every combination plant should be made to see that the combination is working to the benefit of both the employees and the public. This is a very important matter and requires very serious consideration. It is much easier to solve the problem now than it will be after present conditions have been aggravated to such an extent that they are taken up by politicians who will force the companies to suffer very serious and heavy losses.

New Blood in the Organization

Educational work among employees is in every way a commendable and profitable departure. The principle of taking on a man in a minor position and furnishing him with the opportunity of increasing his knowledge to the point where he may, with a proper degree of energy and the necessary aptitude, elevate himself to the highest office in the company, is sound in every respect. Yet enthusiasts are apt to overdo the matter. To some, the ideal condition would be a company in which the executive and subordinate officials came up from the ranks of that same company; in other words, a family affair from which the outsider is absolutely debarred, the only means of obtaining a position in the organization being to get in when young, and to work one's way up through the grades to the worth-while posts.

While admitting the soundness of this theory to a large extent, this journal does not believe that its practice in the entirety would be conducive to the maximum efficiency of the organization, or—if adopted on a universal scale—to the progress of the gas industry as a whole. Each organization needs new blood, new ideas and new enthusiasms in order to progress. To adopt the theory alluded to would be to debar entirely the entrance of such stimuli. It may be argued that the first factor is not sacrificed since each year a new force of young men would enter the company's employment. But these are raw products—they represent new blood, but, yet, are of negligible value. Not having had any experience upon which to base such ideas, they are not in position to furnish ideas that would be of value in the conducting of the company's business. Not having any knowledge of the methods of the gas industry they have no basis upon which to devise new methods.

Potential new blood in an organization is exemplified by the newcomer who has had the advantage of a well rounded experience in other services. A distribution engineer, for example, from the organization of the company serving Philadelphia, would be fitted by training to bring new ideas to the company operating in Chicago. There might be methods in use in the former city which could be adopted to advantage in the latter, and vice versa. In effect, though old methods, they would be new, insofar as the company to which they were introduced is concerned.

An exchange system might well be adopted in the gas industry to the advantage of all concerned. Let us assume that the Consolidated Gas Company of New York has on its payroll two men in the distribution department, who started in the lowest grades, at approximately the same time. Let us carry the assumption farther and imagine that they have both had experience in handling the temporary supplies during the subway construction, that they are practically alike in ability and natural aptitude, and that both have arrived at the point where further progress must lie in advancement to one of the higher offices, which in all companies are very few. Each, moreover, is entitled to advancement, and there is a place vacant for but one. To promote either would be, in a way, an injustice to the other. Let us imagine that the Philadelphia subway work had progressed to such a point that an engineer experienced in temporarily caring for supplies under such conditions would fit in very well. Would the exchange system not be extremely useful in this case?

The proper authority in the New York company would inform the Philadelphia company that he had such a man available. Both employees would get their merited advancement and the Philadelphia company would get a man experienced in a class of work in which it would be impossible for one of their employees who had spent all his active career in its service to have had experience in. The New York company would be the loser in that a valuable employee would be gone from its organization, but it would benefit in that a greater stimulus would be given to other employees to give up their best efforts in the company's service, in the realization that their horizons would not be bounded merely by the vacancies that might occur in their own company's forces, but that they were making themselves specialists in the gas industry. Further, the New York company would benefit in that the Philadelphia company at some future time, and under similar conditions, would reciprocate in like manner and send a, perhaps, badly needed specialist.

This journal believes that, properly worked out, the exchange scheme would prove of great value to the gas industry.

Boston Company Campaigns for Automatic Range Sales

The Boston Consolidated Gas Company, during the warm season, has been featuring the Sentinel Automatic Cook Stove with cabinet and automatic shutoff. Public interest has been greatly attracted to this improved type of range, which is so constructed as to enable the housewife to set a dial at the point which will insure baking or boiling to the proper time limit, and then go about her other household or social activities. It is claimed that the Sentinel Automatic consumes only about 50 per cent of the gas used by other stoves, in performing a given task.

As a means of attracting attention to the Sentinel, the Boston Consolidated is operating an Arnold illuminated sign, which consists of a 6-in. translucent white ribbon, on which is printed an alluring advertisement of the Sentinel stove. The ribbon is run at a rapid rate across the face of a lighted cabinet, and reads as follows:

"Sentinel Automatic Cook Stove Cooks Meals While You Play. No More Pot-Watching. Put Dinner in Oven, Light Gas, Set Dial and Leave Kitchen Until Meal Time. Gas Shuts off Automatically. Oven Acts as Fireless Cooker. Ask About It."

The sign is set in a show window in the midst of a display of Sentinel stoves, the decorations being artificial wistaria flowers, hanging over a trellis.

In addition, the company is pushing, at its appliance store on West Street, the sale of the Acorn, Clark, Jewel, A-B, Garland, Triplex, Direct Action and Glenwood ranges.

Radiators and gas logs will have a foremost place in the salesroom as the cool Fall weather comes on. The Bungalow automatic water heater is also being pushed with prospects of large sale as the weather becomes colder.

The Boston Consolidated will continue to feature the Humphrey gas arc and the Radio-30 light. Large installations for store front lighting have been made in Boston and suburbs.

Municipal Department Becomes Industrial Fuel Customer of New Orleans Company

The following industrial gas fuel business is reported this month by the New Orleans Railway & Light Company.

The Frey Grocery has installed one 35 gallon cauldron furnace for boiling hams with which it expects to greatly increase this department of the business. Two 5-mantle gas arcs have been installed to provide additional lighting.

The Stock Amusement Company has installed a steam table in its lunch room which will have a consumption of 36,000 cu. ft. per year.

The New Orleans Sewerage and Water Board has installed a vulcanizing outfit in its garage which will be operated by a gas fired steam boiler consuming about 50,000 cu. ft. per year.

A two-ring industrial burner has been installed for P. Haas, a grocer, to equip a smaller ham boiling outfit.

The O'Connor Wagon Manufacturing Company has just installed a No. 12 Schuyler spring tempering furnace. This company is re-arranging its paint shop and plans are being made to build a drying room in which case heat will be used. Also brazing burners for removing old paint and a repair shop are in prospect with an estimated consumption of 30,000 cu. ft. per month.

Houston Gas Company Will Win Its Consumers While Young

Among the contracts taken by the Houston Gas & Fuel Company last month was one for a domestic science installation consisting of eight single-oven gas ranges in one of the public schools.

This installation will be used during the coming school year in instructing three hundred children in modern methods of cooking with gas, and will bring the advantages of the gas range to the attention of practically every home in Houston. The value of such installations and the importance of developing them as fast as possible cannot be exaggerated, for not only does it bring the subject of cooking with gas under discussion in every home where there is a child taking this domestic science course, but the other children in the school hear of it and talk of it and from the medium of neighborhood gossip, the story is told throughout the city, and a constant demonstration is being given to prospective customers of the company.

Continuous Barring in Conjunction with Patrol System Used to Reduce Unaccounted For Gas

Lost Gas in High Pressure Systems with Screw-Jointed Pipe Very High—No Trouble Encountered in Welded Mains—Wrought Iron Pipe Used in Rock Trenches in Streets Through which There are No Sewers

The consensus of opinion of those present at the August meeting of the distribution section of the Empire State Gas & Electric Association seemed to incline to the view that condensation was responsible for a considerable loss in high pressure systems, though no one had actual figures to prove it.

In the course of the discussion on unaccounted-for gas it was brought out that one company is using a continuous barring system together with its patrol system to reduce this loss.

Barring in paved highways was talked over, and, in connection with this, it was shown that there is a great difference in the attitudes of the various municipalities toward the companies whose work interferes with pavements.

It was stated that the "unaccounted-for" in high pressure systems with screw jointed pipe was very high. No trouble with leaky joints is encountered in welded mains.

In the discussion under the heading of street leaks and main inspection one company felt that the records of systematic inspection of mains and services were very important in case of suits for damage caused by escaping gas.

The use of wrought iron pipe in clean filled ground was suggested on account of its greater strength in case of settlement of the fill.

One company uses wrought iron pipe in rock trenches in streets through which there are no sewers, as it will offer greater resistance to shock while the blasting for the sewer trench is in progress.

Seeking Customers on the Complete-Installation Plan

There is a satisfaction in reading of the increasing number of cases where complete installations are achieved, states the *Bulletin* of the United Gas & Electric Engineering Corporation. Not many years ago the sole objective of the salesman was to make his individual sales. We are coming to the point where he is looking at the customer in a larger way and gauging what his maximum consumption might be, were the service utilized in every possible form.

The Hotel Deming in Terre Haute, for instance, month after month, has been developed from a small initial installation, until to-day it is an all-gas hotel and the full coal equipment with which this new house began business only two years ago, has been discarded. Richmond reports a dairy lunch that has installed a complete equipment of cooking appliances. Now they expect to heat the building also, so that not a bit of coal will be used on the premises. And so it goes.

Our men who are selling both for gas and electric properties, are taking a broader and more intelligent interest, not in the day's work only, but in the building of the greater future for their company and for themselves. Their idea of service has a greater measure than it used to. The spirit of the work to-day has come to be—"How can the service be applied to each consumer so that every process of light, heat and power needed in the premises may be embraced?"

New York Companies do not Forget Employees on Mexican Border

According to *Gas Logic* for September, 297 men employed by the lighting companies in New York City went to the Texas-Mexican frontier with the various New York City regiments. Several thousand copies of *Gas Logic* for July and August were sent to the New York City regiments stationed at McAllen, Texas. In the particular issue photographs of the New York soldiers reading *Gas Logic* down in the Texas camps is reproduced. It is easy to see that between the soldiers and their families, and the New York City gas companies a considerable amount of "good will" has been engendered, which will probably durate for many years.

Effect of War on Gas Business in Germany Has Been to Impress Upon the Country the Great Economic Importance of the Industry

Productive Capacity of Plants Increased by the Introduction of Improved Carbonizing Methods—Yield of Gas per Ton of Coal Has Been Raised 1,041 Cu. Ft. in Period of Ten Years—Much Greater Use of Gas for Industrial Fuel

That the war has not been altogether a calamity for Germany, at least insofar as the gas industry in that country is concerned, is strikingly brought out in the guarded utterances of M. Hase, in his presidential address before the German Association of Gas and Water Engineers in Berlin, June 28. While the war has brought new problems before the industry the solution of them has been beneficial to its progress, and has impressed upon the public the great economical importance of gas to the country.

New Problems Brought Before Gas Industry

The prolonged war has naturally brought new problems before the gas industry and some attendant difficulties, but it has done the industry the service of impressing on wide circles a knowledge of the great economical importance of gas. The war has accomplished at one stroke what years of patient endeavor failed to achieve fully, and the gas industry has now received due recognition of its worth in affording the most favorable and thorough utilization of coal, and in providing by-products which are indispensable for the fulfilment of problems of national importance. Gas stands foremost as a substitute for petroleum, and on this account Germany has adopted every measure, not merely to avoid any restriction in the production of coal gas, but to stimulate the production.

Thanks also to decades of strenuous technical and scientific preparation, the gas industry was ready for the introduction of new branches of manufacture, and to undertake heavier tasks with good results in the direction of rendering Germany independent of imports.

The time is not ripe to go into details of the manner in which German gas-works have equipped themselves to assist in the struggle, but attention may be drawn to two points: The adoption of measures to increase the productive capacity of gas plants by the introduction of carbonizing methods which have been perfected technically and economically, and the adoption of measures for facilitating and furthering the output of gas by favorable rates of charge, the introduction of prepayment meters, the distribution of gas at higher pressures, opening new fields of consumption, especially of an industrial nature, and notably distribution from large central gas-works to outlying places.

The Passing of the Single Horizontal Retort

Not long since—say, 20 years ago—the single horizontal retort charged by hand held a monopoly, whereas in 1914 there were in 100 of the largest German gas-works 11,042 horizontal retorts, 7,710 inclined retorts, 5,605 vertical retorts, and 728 large carbonizing chambers. Thus horizontal retorts are already in a minority, and their character has changed for the most part from the "single" to the "through" retort with mechanical stoking. Frequently horizontal retorts are only being retained as emergency plant, the regular work being done with the more economical vertical retorts and large chambers, while several gas-works take a supply of gas from coke-oven works.

The average make of gas per ton of coal in 87 large German gas-works has risen from 10,585 cu. ft. in 1893 to 11,626 cu. ft. in 1913, which means a gain of about 5,120 million cu. ft. of gas per annum, through the better utilization of the coal carbonized.

At the same time, also, the coke obtained has risen from 64.7 per cent of the weight of coal carbonized in 1893 to 70.8 per cent in 1913, which represents a gain of 300,000 tons of coke per annum.

Measures Adopted to Increase Use of Gas

Outside the gas-works, measures have been adopted for increasing the employment of gas. The fanciful notion which was prevalent before the war that gas would, in the near future, be restricted to a few fields of operation to which it was specially suited has been dispelled once and for all, and the seal has been set by the war on a more extended charter for the gas industry. In the words of the last report of the German Central Gas Bureau: "It is for the gas industry to take care that coal, the most important German treasure of the earth, disburses without loss the wealth of materials which it contains, and that to this end the combustion of raw coal, not merely for household but also for industrial purposes, is continually displaced in favor of gas."

It is indeed, not surprising that, even before the war, there was a continuous and highly gratifying expansion in the use of gas. The average consumption of gas per annum per head of the population was 1,942 cu. ft. in 1893, 2,684 cu. ft. in 1903, and 3,708 cu. ft. in 1913.

Effect of the War on Gas Consumption

At first the war interrupted the natural expansion of the gas industry, so that from August, 1914, to May, 1915, there was a decrease in the output from German gas-works which averaged 3.8 per cent, but from June, 1915, onward the output has increased.

Thus the consumption from large and moderate-sized works in 1915-16 has averaged 6 per cent more than in 1913-14, the period immediately before the outbreak of war.

This increase would have been greater but for artificial obstacles, such as restrictions of all sorts, the inadequate productive capacity of many works, shortage of materials, etc. It is of interest to note that gas-works situated close to the field of war have had exceptionally large increases in output, owing primarily to the military traffic, but partly to low charges and the greater use of gas for industrial purposes.

Diminution of gas consumption has been caused by general economy, breaking-up and reduction of households, less business at public houses and restaurants, suppression of festivities, bad business and earlier closing hours, depression in many industries, especially in connection with the export trade, shorter working hours, and reduced public lighting.

On the other hand, increase of gas consumption has been brought about chiefly owing to growth in the number of consumers in consequence of scarcity of petroleum, to the use of coal gas in place of oil gas for railway carriage lighting, to the scarcity of fuel, to the supply of military buildings, hospitals, etc., as well as industries and plants engaged in war work, and to the growth of home work for war purposes, etc.

Prospects of Future Development Bright

The prospects of development of the gas industry in the future are bright. Increasing calls on gas-works may be anticipated when peace brings a revival of commerce, and the present enforced economy ends. In addition to the continued replacement of petroleum by gas for lighting purposes, there will be new outlets for gas which the war has disclosed, such as the lighting of railway carriages by coal gas, the use of gas in industries and trades, as well as the supply of villages and outlying communities.

Gas firing will extend for annealing, smelting, welding, and general industrial heating in workshops and engineering works. The war has advanced by a long stride the question of the economical utilization of coal, and it is now recognized that the monstrous wastefulness of the wealth locked up in coal will be checked by the extension of the use of gas in industry, and for domestic heating in all directions, with collateral hygienic benefits to the population.

When Lacking a Boiler, Use a Locomotive

Failure of Relief Boiler During Repairs to Large Boiler Forces Small Plant in New Jersey to Adopt Novel Expedient to Keep the Works Going

N. A. McClary, superintendent of the Ocean County Gas Company, of Toms River, N. J., has informed this journal of a novel expedient adopted by a small high pressure plant in New Jersey to keep the works going during an unexpected emergency.

The large boiler in the plant developed a leak and had to be shut down for repairs. The relief boiler failed to live up to its name, and gave out almost immediately upon being put into operation, leaving the plant without steam.

A hurry call for assistance was sent out to an electric plant about 200 ft. distant, but the steam was not available for 24 hours. In the meantime a locomotive was obtained from the railway company, run on siding and coupled up to the plant, putting it back into commission until the repairs could be made to the damaged boiler.

Greatest Advantage Electricity has had Lies in Fact that Gas Man has been Asleep

The greatest advantage we electric people have had during the last quarter of a century has been the fact that the gas people have been asleep, stated Samuel Insull, chairman of the board of the Peoples Gas Light & Coke Company of Chicago, in a recent address. If they had been alive to their opportunities and the possibility of the diversity of business that could be created by a system of differential rates of one form or another, we would never have had the opportunity in the electric business that we have had. Instead of taking twenty-five years to achieve what the electric companies have, it should have taken us nearly seventy years if the gas people had been alive to their opportunities.

The gas people are waking up. I read a report of one of our associations the other day which shows that they are profiting by our experience, and the system of gas rates will be revolutionized in this country within the next few years.

Bear in mind that we utility men have a great opportunity to do some good. We can, if we will, improve our business to the highest point of efficiency, and then we are not only doing ourselves good and our security holders good, but we are doing something to help develop the country of which we are citizens and to which we owe our support and allegiance.

That point of view ought to and does influence public-utility men in this country. They have opportunities that few men engaged in private business have. They are more or less semi-public servants; they should perform their functions with a recognition of their duty to the state. It is easy enough to give advice on these things, and especially so if a man does not take much part in the details; but bear in mind, I have been through the same mill you all have gone through; I started as low down in the business as any of you. I had to do with the building and the operation of the first central stations built anywhere; I have been in the business ever since.

As I look back over my career at the things I would like to correct to-day and the mistakes I would have preferred not to make, one mistake is that of looking too much to personal interest and not to the interest of the community. We are fortunately engaged in a business that enables us to do something for the community, and if we are doing it in the right way we are pursuing our own interests and putting our industry on the highest possible level.

In the course of my remarks I have given some figures showing the enormous amount of money invested in the public-utility business and the very large revenue that is to be obtained in order to pay wages. I have told you of the very large number of people employed in the great utility operations of this country. The capital invested is not owned by a few. I do not have the number of stockholders, but it is not a small number. That capital is represented by securities owned by the widows and orphans and the savings of the workers of this country.

It is a mistaken idea for any one to imagine or declare that the great captains of industry are the men who own these great utilities in these United States. I care not what fortunes the newspapers may ascribe to them—and of course they usually ascribe to them whatever looks best in the headlines—but add them all together, and you will see what a ridiculously small proportion in public-utilities investments are represented by great fortunes.

The people who have their money invested in these utilities are just as much entitled to protection in a country as broad as the United States as the wage earner has a right to protection and as the consumer of any one of our products has a right to protection. If we were more careful of fulfilling our duties of citizenship, and impressing upon our employees the fulfillment of their duties of citizenship—not their duties as we see them, but their duties as they, the employees, see them—if we would follow the course some few of us follow, trying to get our employees to invest their savings in our utilities, you would find, in the long run, that we would get just as much consideration as we deserve from these regulating bodies, and that instead of dealing with the interests of the public, less the interests of the owners and operators of the utilities, they would deal with the interests of the whole public.

What is going to happen if public regulation fails? There is only one thing can possibly come, and that is public ownership. I would go so far as to say that I think if public regulation fails, public ownership should come. I think the question as to whether public regulation will fail is a question that is very largely up to the public-utility men of the United States. If the public-utility men of the United States show a determined opposition to commission forms or other forms of regulaton, it is but natural that the public will turn to public ownership. For myself, I cannot take the position that I am engaged in a business that can only be run economically as a monopoly, and refuse to concede that such monopoly should be regulated. Neither can I take the position that if regulation, on the whole, fails, public ownership should not be tried. It is our duty to see that public-commission regulation or local municipal regulation, whichever exists, succeeds. It is our own business—our vital personal interest—to see to that as owners and operators of properties.

It is all well enough to argue, "How can you expect public ownership to succeed if public regulation does not succeed?" I do not think it can. It lacks the incentive that goes with the desire for personal achievement, personal improvement, position and wealth; but the people will insist on public ownership if public regulation does not succeed; and we are drifting toward a situation which it is impossible for owners of local properties to control. As we get farther and farther away from the local utility and nearer and nearer to the state-wide utility, it is a foregone conclusion that every state will have some state form of regulation; and the best thing we in the business can do is to do our best to see that public regulation is successful.

The advice I would give to all you gentlemen here is to see that, whatever form of regulation you have, whether by local authorities or state authorities, whatever you do, you do your level best to maintain most cordial relations with those bodies. It is the duty of all of us to see that cordial relations exist between the properties we run and the communities we serve. It will give you a bigger return on your investment. First, cordial relations with the community and then cordial relations with the employees.

You can only get this by straightforward, open methods of dealing. Take the public into your confidence, not as a favor to them, but as their right. Next to the ordinary government duties of the management of the community, we are performing the greatest public duties in the community in which we live. We are getting our income from the communities; we are depending on them for our success, and, therefore, the wise thing for us to do from the point of view of the narrowest self-interest, is to take them into our confidence and treat them with absolute fairness.

News of the Gas Industry

5,000 Gas Lamps in Residence Streets of St. Paul

There are 5,000 gas lamps in the streets of St. Paul, Minn., which has earned the reputation of being one of the best lighted cities in the country.

Prisoners of War as Gas-Fitters

Some time ago the Prussian War Office was persuaded to establish courses of instruction in gas-fitting in prisoners' camps, or to train prisoners as fitters in some of the larger gas-works, in order that they might be placed at the disposal of other works. In several districts the results have been satisfactory, where the step has dispelled many objections which were brought against it, such as that it would not be practicable to provide the requisite supervision of the prisoners, that it was inexpedient that they should have free intercourse with the public, that it would likely rouse the opposition of industrial workers, that ignorance of the German language would cause trouble, that German workmen would not work with or under prisoners, etc.

Urges Municipalities to Help in Tests for Calorific Standard

The mayors of Fall River and Northampton, Mass., have received a letter from Alton D. Adams, a Boston public utility engineer, in which he points out the desirability of municipal interest in the tests now going forward, in anticipation of the establishment, by the Gas and Electric Light Commission, of a heat unit standard for the manufacture of gas in the state.

Mr. Adams represented the two cities at hearings before the commission several years ago. He says:

"Since 1892 the standard for gas has been 16 candlepower under the statistics of the Commonwealth, but Chapter 167 of this year authorizes the gas commissions to establish a heating standard and to suspend the candlepower at various plants. It is no doubt the plan of the gas interests to have the candle standard abolished shortly after the above heating standard is established.

"As shown by numerous official tests in this Commonwealth and elsewhere, the present standard of 16 candlepower insures generally about 575 to 700 heat units per cubic foot of gas, the lower figures applying to water gas or mixed water and coal gas, and the higher figures to coal gas alone or enriched.

"For a number of years many gas interests have been trying to abolish the candlepower standard and to substitute a heating standard so low that the present candlepower standard will be reduced 40 to 50 per cent, and the present heating power 20 or more per cent, and these results are apparently about to be realized.

"Tests and hearings are being conducted to determine what heating standard shall be adopted, and 500 heat units per cubic foot has been mentioned as the probable figure. Coal or water gas can be made with 300 to 800 heat units per cubic foot.

"If cities are to obtain reductions of gas rates in proportion to heating power, not to mention candlepower, they should take part in directing the tests now being made on the different methods of manufacture for this purpose."

Manager Day of the Northampton Gas Light Company made the statement that the test is not for any arbitrary action by the Commissioners, but for the purpose of satisfying themselves as to what change in standard shall be fixed without affecting the efficiency of the lighting service. He stated that the use of gas for heating had reached a point where 65 per cent of the local consumption is for heating. Mr. Day believed an increase in the heating power of gas is a desirable object to be accomplished.

Consider Rebuilding of Municipal Gas Plant at Bellefontaine, Ohio

Stated that City is Losing Money at Present Rates—Price of Fuel Gas to be Raised

The price of fuel gas, now sold at Bellefontaine, Ohio, for 50 cents per thousand feet from the municipally-owned plant, is due for an early increase in price to 85 cents, which is to be the single rate used for figuring all sales of gas. Gas used for illumination purposes is now sold at $1.25 per thousand feet.

The action of the Board of Control that will change the price has not been taken as yet, but Mayor Kennedy and Server Inskeep are in favor of the change and in conference with all of the members of Council, except Councilman Reinhart, Aug. 28, the matter was discussed and agreed upon.

City officers state that the gas works is now running behind because of the increased cost of materials.

In the same meeting it was agreed to submit to the voters at the November election two bond issue propositions, one to build a new gas plant at a cost of from $25,000 to $50,000, and another to install a new pump at the Water Works at a cost of from $10,000 to $20,000.

The tentative decision to increase the price of fuel gas is the result, city officers say, of the increased cost of production. Ten years ago the city was receiving an average of 75 cents for all the gas manufactured. The 85-cent price which is contemplated will, with the 10 per cent cash discount, bring the price to within 2 cents of what it was a decade ago when labor and material were cheaper, and the plant was in a more efficient condition.

If the voters should, at the November election, authorize the rebuilding of the plant, it would be possible, it is believed, to manufacture gas at less expense.

Because many persons who used gas for illuminating purposes ten years ago have since adopted electricity for lighting, and because the number of fuel consumers has very largely increased the average price which the city is now receiving for all the gas sold is 54 cents per thousand feet. Server Inskeep says the labor and material is now costing 58 cents per thousand without taking into consideration repairs, depreciation, interest on the investment or other overhead charges, so that the city is actually suffering a loss on the gas sold.

Before the Board of Control takes the final steps that will establish the 85-cent rate there will doubtless be much discussion.

Some years ago when Charles Buchanan was in charge of the Gas Works as a member of the Board of Public Service, he advocated an 85-cent rate for both kinds of gas, but at that time the citizens fell upon the suggestion and defeated the movement upon the argument that an 85-cent rate for fuel gas would be ruinous.

Brainerd, Minn., Gas Plant Put in Operation

The recently completed Brainerd, Minn., gas plant was put in operation Aug. 28. The plant is situated near the Mississippi bridge and Laurel street. The gas station is a two-story brick building 85 ft. long and 45 ft. wide.

At 12:30 p. m., in the presence of President Whitney, of the Brainerd Gas & Electric Company, D. C. Tenny, vice-president of the American Gas Construction Company, H. G. Williams, general superintendent of the gas department, Jerome Spiering, the local superintendent, and Henry I. Cohen, N. H. Ingersoll, F. A. Farrar, R. R. Wise, R. M. Sheets, M. C. Sheets, J. W. Koop, F. H. Simpson, John A. Hoffbauer, Carl Adams, and C. E. Hansing, steam was turned on and the blower started. At 12:55 the compressor started in action.

D. C. Tenney, constructor of the plant, made an address on how the gas is manufactured and explained every step of the process.

Typhoid Fever from Drinking Water Held an Accident

The United States Circuit Court of Appeals, Ninth Circuit, recently handed down a decision which laid down the principle that the contracting of typhoid fever by employees as the result of drinking impure water furnished by the company is an accident arising out of the conduct of the business. The main parts of the decision, by Judge Ross, are as follows:

The defendant in error, the Pacific Gas and Coke Company, being engaged in the construction of a gas plant and having employed in the work a large number of men, secured from the Aetna Life Insurance Company, the plaintiff in error, a policy entitled by the latter "contractor's employers' liability policy," by which, in consideration of certain premiums which the case shows the defendant in error paid, it agreed to indemnify the assured against loss and expense arising or resulting from claims upon the assured for damages on account of bodily injuries or death accidentally suffered, or alleged to have been suffered, by an employee or employees of the assured by reason of the business as described and conducted at the locations named in the policy, with certain exceptions not applicable here. In the course of the work certain of the employees of the company contracted typhoid fever from the water furnished them by the latter, on account of which that company was compelled to pay damages to such injured employees, to recover the aggregate amount of which from the insurance company the present action was brought. And the sole point here presented is whether the harm so done to the workmen constituted a bodily injury accidentally received or suffered by them, within the meaning of the policy in question.

Of course it is not and cannot be doubted that the workmen were bodily injured by the drinking of the water in the course of the work, for it contained typhoid germs, which gave them typhoid fever; but it is insisted on the part of the plaintiff in error that in drinking the water they were but satisfying a natural want, and that in doing so there was no accident about it. It is readily conceded, of course, that there could be no accident in merely drinking water; but it is just as certain that the men would not have drunk it had they known that the water contained typhoid germs. The accident consists in that unexpected happening. Among the definitions of the word "accidental," in most, if not in all, of the dictionaries, is the happening of "something unexpectedly, unintentionally." Suppose, instead of containing typhoid germs, as in the present case, the water that the employees of the assured consumed had contained some of the most virulent poisons, would anyone contend that the injuries resulting therefrom could not be properly held to have been accidentally inflicted? We think not, and yet, in our opinion, there is no substantial distinction between the case supposed and the case at bar.

Sheridan Gas Company to be Ready About Oct. 1

The Sheridan, Wyo., Gas Company has five and one-half miles of main laid and much of the work at the plant completed. If there is no further delay in receiving material, the plant will be ready for operation by Oct. 1 or soon after.

The building of the plant is all completed with the exception of the roof, the construction of which is being delayed because of the lack of steel for the trusses. The storage tanks are in the course of erection.

How to Get Hurt

Don't mind the safety signs—they're for decoration.

Don't wear goggles when using an emery wheel or chipping—then the chips can get into your eyes.

Don't use both hands when climbing a ladder, or you are liable to get to the top without falling.

Don't pay attention to your feet when dropping material—if you do, it may not hit them.

Don't report the careless workman—he may hurt you next.

Don't be neat about your work—untidy conditions cause accidents.

Don't report a dangerous place—you may be the one it will get.

Don't pay attention to slight cuts, or you won't get blood poison.

Don't pay attention to safety rules—you won't get hurt if you do.

Don't hunt for gas leaks by smelling or using soap-suds—use a match or you won't have an explosion.

Don't give a darn about safety first—you may not be found out.

—*The Bulletin* of the United Gas & Electric Engineering Corp.

Explosion Occurs at Fitchburg, Mass. Plant

Brick Walls of Purifying Building Shattered; Night Watchman Injured by Explosion

An explosion in the purifying building of the Fitchburg Gas & Electric Light Company's plant between Summer Street and the railroad tracks shortly before 7:30 p. m., Sept. 2, blew out the west side of the large brick building and shattered the other walls so that before operations can be resumed they will have to be rebuilt.

William Custer, 60 years old, the night watchman at the plant, while making his rounds noticed that the mixture in the purifying room was not what it should be. He finished making his trip around and then returned to the building preparatory to regulating it. He opened the door and the explosion occurred. He was thrown 20 ft. by the concussion but escaped serious injury as almost as the report of the explosion sounded bricks from the damaged wall came tumbling to the ground. He received bruises and abrasions about the arms and legs and superficial burns about the body. It is expected that the entire damage will reach well over $1,000.

An employee working in the rear of the building heard the report and arrived at the scene just in time to assist the watchman to his feet and, after assuring himself that the watchman's injuries were not fatal, sounded an alarm. By this time a number of employees had arrived at the scene and found that the entire side wall, about 50 ft. long and two stories high, had been blown out. The roof, which is of wood, had sufficient support from the remaining walls although it had become ignited from the flames which were shooting high in the air. Precautions against another explosion were taken and a water line from the private hydrant on the grounds was laid. Effective work was done by the employees with this, and by the time the department arrived practically all the fire had been put out, although there was still a flame from the air feed pipe which runs into the building. District Chief Henry J. Hyatt, who was in charge of the department, directed that this be smothered with burlap. While the men were preparing the cloth an employee shut off the flow of gas.

Utilities Represent Capital Investment of $30,000,000,000

The public-utility business includes the electricity-supply business, the gas business, the telephone business, the street and electric-railway business and the steam-railroad business of the United States. The business of these various utilities represents a total operating revenue of $4,313,000,000, of which about 30 per cent, or a little more, is local public-utility business. This total business yields a net revenue of $985,000,000 a year; it pays taxes, municipal, state and federal, of upwards of $200,000,000 a year; it has securities issued of upwards of $25,000,000,000; it has assets of nearly $30,000,000,000; it pays salaries and wages of between $1,750,000,000 and $2,000,000,000, and it employs 2,250,000 men. Two-fifths of the capital employed is used in local utility business alone. A little more than that proportion of the income comes from the local utility business. The local utility business pays about the same proportion of taxes.

Publicity of Accounts

To my mind, one of the greatest advantages, to all of us, of some definite regulating body is the publicity of our accounts and our affairs that must necessarily follow, and the preparation of statements made under the rules and forms laid down by the regulating body, and the resulting confidence that the public must gradually acquire in these statements, because they know that they are not made in the form or under methods which have a bias toward the prejudices and interests of the operators of the property.

—*Extract from recent address of Samuel Insull.*

Increase of Maximum Pressure in Cities of Second Class Desirable

In the discussion of the topic, pressure, control and equalization, at the August meeting of the gas distribution section of the Empire State Gas & Electric Association, it was brought out that an increase of the maximum pressure which may be carried in cities of the second class might be desirable.

The limits of 2-in. minimum and 6-in. maximum were suggested, the general opinion being that such change would increase the efficiency of consumers' appliances and would decrease the number of complaints of poor pressure. It should not greatly increase the leakage in a properly cared-for distribution system.

Lenox, Mass., to get Gas from Pittsfield Company

Within a week Lenox, Mass., will be supplied with gas from the Pittsfield Coal Gas Company's plant. The company has almost completed the pipe line connections between its works and Lenox.

New York & Richmond Company Sold to Dawes Syndicate

The Dawes Syndicate, in conjunction with local banking interests, have purchased control of the New York & Richmond Gas Company, operating in the Borough of Richmond, Staten Island.

The negotiations were handled by M. M. Freeman & Company, of Philadelphia, and William B. Walter, of Chicago.

"Combination" Company Pushes Gas End of Business

The Fitchburg (Mass.) Gas & Electric Company reports substantial gains in its gas department for the year which ended July 1. Meters gained numbered 657, ranges installed, 852; water heaters, 220; radiators, 602; tenements piped, 271; tenements fixtured, 390.

The company's slogan is "Gas—an Increased Output for 1916."

Laundry Stove Campaign in New Orleans Achieving Splendid Results

A campaign to supplant the typical New Orleans charcoal laundry stove with the "Safety First Gas Laundry Stove" is being pushed by the New Orleans Railway & Light Company, with gratifying results.

There are 30,000 charcoal furnaces in use in the city of New Orleans for boiling clothes and heating flatirons. From time immemorial, the New Orleans people, white and black, have boiled their clothes in round boilers over charcoal, and the records show that an average of one fire a week is caused by such stoves. This type of stove is therefore a serious fire hazard.

Obviously this offered an interesting prospect for gas sales if a stove could be developed that would fit in with the New Orleans custom, and some time ago Commercial Manager W. E. Clement succeeded in devising such a stove.

The campaign was begun last month and the new "Safety First Gas Laundry Stove" has been accepted by the public with enthusiasm. The sales have so far exceeded the expected demand, and the company has been unable to secure deliveries fast enough to keep up with the sales, for each day the regular salesmen in the course of their ordinary routine business, bring in orders for from ten to twelve laundry stoves. This business is secured with little effort, by simply describing the stove in every home the salesman enters, and pointing out both its convenience and safety features.

Fraud Efficiently Guarded Against in New Type of Prepayment Attachment

Helme & McIlhenny, gas meter manufacturers of 1339 to 1349 Cherry st., Philadelphia, have put out a new type of prepayment attachment which, it is claimed, represents a distinct mechanical improvement, and which efficiently guards against fraud. The prepayment mechanism outside the meter is known as the angle slot part, and that inside as the "E" Waggner prepayment movement.

The angle slot part was designed with especial regard to strength and simplicity, to withstand use, abuse, and fraud. All parts are massive in relation to their ordinary duties, and will fail, it is believed, if at all, only under extreme violence.

PREPAYMENT MECHANISM IS OUTSIDE

The draw-bar used to protect the slot has been dispensed with, the slot being closed (on turning the handle) by the wall of the coin carrier, and remaining closed until the coin carrier is returned to its first position. The stops limitment of the coin carrier have been placed inside the iron casting, avoiding clogging by dust and dirt. The lower or delivery slot has been widened to facilitate the passage of the quarter into the cash-box, and to prevent "hung" coins.

The "E" Waggner prepayment movement has a leather-faced prepayment valve with a sharp seat, so that leaks, the most frequent cause of "money wrong" conditions, are not likely to occur. The mechanism is arranged to bring very strong pressure between valve and seat in case of a leak, tending to make the valve tight. Over twice as many quarters can be put in at one time as formerly.

The manufacturers believe that the new attachment represents a distinct mechanical improvement, being practically troubleproof, with no sacrifice of the convenience and ease of repair, and the standard of material and finish, that marked their previous device.

What Was the Gas Company Doing in the Meantime to Hold this Lighting Business?

The following editorial from the *Bulletin* of the United Gas & Electric Engineering Corporation prompts the question: "What was the gas company doing in the meantime to hold this lighting business?"

"An account comes from Little Rock this month of how Mr. Lewis of the Commercial Department had a prospect, a druggist, whom he called on monthly for a long time. This druggist used gas light but Mr. Lewis argued for the Mazda C without result, until one day he dropped into the store and there, behold, were Mazda C lamps happily installed upon the ceiling. The druggist showed great pride in them and told Mr. Lewis that he had had this change in mind for over a year and that it was his own idea, etc., and Mr. Lewis never smiled.

"Why should he?

"The thing that he was after was to get electric light in that drug store and there it was. Without his knowing it, without the druggist realizing it, the influence of his arguments had gradually produced the change of attitude and then the change of light, which proves again that no refusal can be final. For as long as men are human they will change their minds."

War Has Brought Many New Consumers to German Gas Companies

The number of gas consumers in Germany has been greatly increased since the outbreak of the war. In Lubeck the working year 1915-16 has seen an increase over 1913-14 of 50 per cent in the number of consumers, of 31.5 per cent, in the number of ordinary meters fixed, and of 144 per cent in the number of prepayment meters. Other places report similar figures. The demand for new services and fittings has frequently been so great that the works themselves have been unable to satisfy the impatient public, and have had to get the assistance of private firms in fitting meters and prepayment installation. Various arrangements were made with these firms, who likewise were suffering from lack of skilled labor, but, incidentally, the war has helped through this cooperation to reconcile hitherto opposing interests.

Societies and Associations

THE EMPIRE STATE GAS & ELECTRIC ASSOCIATION will hold its annual convention in the United Engineering Societies Building, New York City, Oct. 5 and 6. As far as completed to date the program will include a paper on "Taxation" by Paul S. Andrews, one on "Extensions" by Carl F. Graf, and one on "Accident Risks" by C. E. Morrison. During the year Mr. Andrews has made a careful study of the tax laws as they apply to the gas and electric companies, and has prepared a review of the subject for the association. Mr. Graf, as the vice-president of the Municipal Gas Company, has looked into the matter of extensions very thoroughly, and has developed a plan for his own company which he will explain. He will also refer to the commission decisions in regard to the subject. Mr. Morrison is engineer with W. S. Barstow & Company, and is also treasurer of the Utilities Mutual Insurance Company, and in this capacity has collected a large amount of very instructive data as to accidents in different branches of the business and relation of losses to premium rates. Various committees will make their reports and submit their plans for the coming year. The annual election of the officers and members of the executive committee will take place. An amendment to the by-laws enlarging the executive committee will be acted upon. A buffet luncheon will be served in the room adjoining the meeting room on Oct. 5, and on Oct. 6 the delegates will lunch together at the Engineers' club.

THE COUNCIL OF THE IOWA DISTRICT GAS ASSOCIATION decided that the convention of the association would be held in Des Moines, May 22-23, 1917, at a meeting held in Des Moines, Aug. 25.

Personal Notes

JOSEPH S. STRING, for the past three years superintendent of the Brockton Gas Light Company, has resigned on account of ill health and will leave for an extended trip through the south.

E. G. CONNETTE, formerly general manager of Worcester Consolidated Street Railway Company and now president of the International Railway of Buffalo, has been made president of the Electric Engineering Corporation of New York City.

M. T. HINE of the New York public service commission has been retained on rate regulation matters by the city of Richmond, Va.

IRA C. MISNER has again been appointed salesman for the Citizens Gas and Fuel Company, of Terre Haute, Ind.

Construction Notes

LITTLE ROCK, ARK.—W. F. Booth, manager of the Little Rock Gas and Fuel Company has notified the mayor of the city that the work of extending the gas mains from the terminus on West Fourth Street to Baring Cross will be started in the near future.

MACON, GA.—Macon Gas Company plans to improve plant on Walnut St. Approximate cost about $25,000.

CARBONDALE, ILL.—Ground has been broken for the installation of gas mains which will give Carbondale a gas supply within a few months in the west side of North Normal Avenue between Jackson and Oak Streets.

WEBSTER, MASS.—The Webster-Southbridge Gas & Electric Company is laying a four-inch gas pipe connecting the plant in Webster with the auxiliary plant in Southbridge. The pipe is to follow the Ramshorn district road and will be approximately 12 miles in length. Efforts are being made to complete the line before cold weather sets in.

MUSKOGEE, OKLA.—Bids have been received for the contract for supplying the city with pipe for the municipal gas pipeline that is being built. The first bid was declared too high and probably will not be considered.

MUSKOGEE, OKLA.—C. E. Honnold of Oklahoma City was the successful bidder Aug. 25 for the $100,000 municipal gas bonds voted to build a municipal gas line from Muskogee to the Brushy Mountain field.

NORMAN, OKLA.—A proposition has been made by the newly organized Norman Gas and Power Company to furnish natural or artificial gas to the people of Norman within one year. The officers of the new company include J. B. Dudley, Clyde Pickard, A. McDaniel and R. McMillan, all local citizens. They expect to run a pipeline from the Maud or the Ada Fields.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas and Electric Company has been ordered to extend its gas mains to furnish service to people living in blocks 41, 42, 54, 58, 59, 60, 61, 69, 70, 71, 72, 73, 75, 76, 81, and 84 in Shields South Oklahoma City addition.

WASHINGTON, PA.—Work has been started on the new gas plant for the Hazel Atlas No. 2 gas plant. The excavating has already been started and work is being rushed in order to be completed by the winter. It will produce about 1,000,000 feet of gas per day.

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,196,019: GAS-HEATER. Truman G. Palmer, Chicago, Ill.

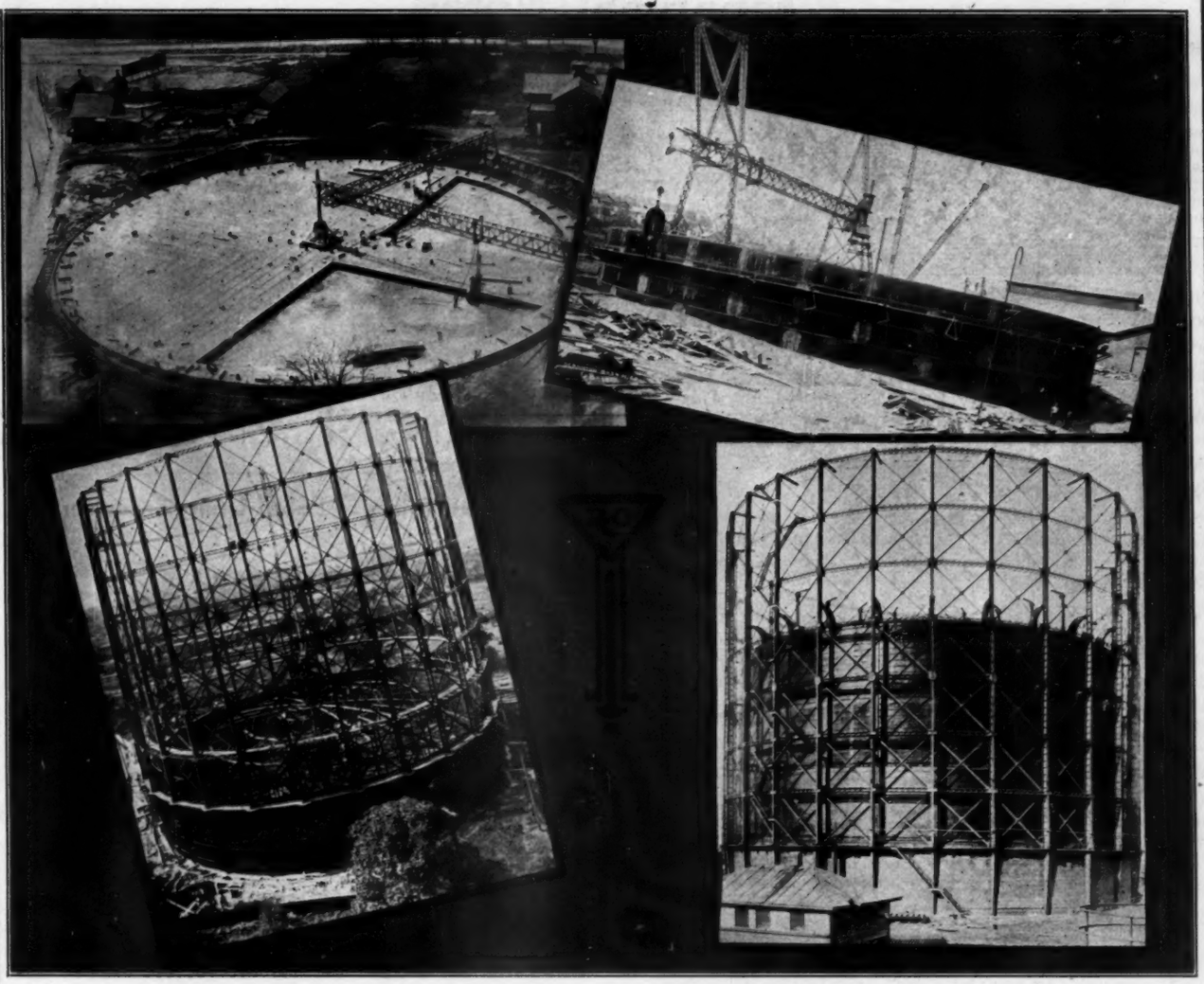
1,196,141: ODORLESS GAS-HEATER. Odel D. Orvis, Newark, N. J.

1,196,230: GAS-BURNER. George W. Graves, Cincinnati, Ohio, assignor to The Graves Supply Co., same place.

1,196,321: METER-PROVER ATTACHMENT. Edwin C. Weisgerber, Pittsburgh, Pa., assignor to Equitable Meter Co., same place.

1,196,455: SAFETY GAS-VALVE. Frank J. Hesse, West Orange, N. J.

1,196,653: GAS-METER. William L. Brown, Lansdowne, Pa., assignor to Helme & McIlhenny, Philadelphia, Pa.



RITER-CONLEY COMPANY

STEEL CONSTRUCTION

PITTSBURGH

HELME & McILHENNY

1339-1349 Cherry St., Philadelphia, Pa.

ESTAB. 1848 H&McI High Grade Meters

GAS METERS

HINMAN DRUM STATION METERS, FOULIS GAS GOVERNORS
PREPAYMENT METERS

REPAIRING AND CONVERTING

PROMPT SHIPMENTS - - - - - CORRESPONDENCE SOLICITED

Financial Notes.

THE FALL RIVER GAS WORKS COMPANY issues the following report:

Real Est.	$ 354,274	Capital	$1,127,000
Machinery	1,775,329	Other debts	27,591
Cash & dts. rec.	157,109	Accrued taxes	17,940
Supplies, etc.	107,292	Prem. on cap. stk.	577,348
Autos	4,183	Profit & Loss	477,277
Adv. pay.	2,516	Res. for depren.	173,347
Money Rec., etc.	8,005	Guaranty fund	8,005
Total	$2,408,508	Total	$2,408,508

THE AMERICAN PUBLIC UTILITIES COMPANY reports, for year ended June 30, $3,309,586, increase, $989,991; net after taxes, $1,466,785, increase, $485,906; balance after preferred dividends, $160,233, increase, $19,685.

THE ILLINOIS TRACTION COMPANY reports for July gross $950,390, increase, $89,096; net, $337,312, increase, $12,962. For seven months ended July 31 gross was $6,804,540, increase, $551,055, with net of $2,551,415; increase, $209,520.

THE U. S. PUBLIC SERVICE COMPANY reports for July gross $78,486; increase, $10,434; net, $31,158; increase, $5,742; surplus after charges, $17,783; increase, $5,286. Twelve months gross, $1,015,126; increase, $132,040; surplus after charges, $293,275; increase, $79,898.

THE ST. JOSEPH RAILWAY, LIGHT, HEAT & POWER COMPANY has applied to the Missouri Public Service Commission for authority to execute a new first and refunding sinking fund mortgage securing an authorized amount of $15,000,000 5 per cent thirty year bonds. Authority is also asked to issue under the new mortgage $826,000 bonds, of which $326,000 is to be used to retire an equal amount of the first mortgage bonds of the St. Joseph & Savannah Interurban Railway Company.

THE TENNESSEE RAILWAY, LIGHT & POWER COMPANY reports combined earnings for seven months ended July 31, 1916, of $2,710,604; increase, $524,160; net after taxes and rent, $1,270,121; increase, $378,138; surplus after charges, $428,803; increase, $363,120.

THE UNITED GAS & ELECTRIC CORPORATION reports earnings for the fiscal year ending June 30 of $1,428,058, from all sources, after deducting all expenses. Interest on bonds and amortization of debt discount amounted to $528,981, leaving a balance of $889,076. Dividends amounting to $649,936 were paid in the year, leaving a surplus of $249,140.

THE SOUTHERN CALIFORNIA GAS COMPANY reports the following earnings for the twelve months ended July 31:

Gross earnings	$967,192.82
Operating expenses, maintenance & taxes	598,063.56
Net Income	$369,129.26
Bond interest (only)	194,700.00
Other interest charges	35,749.49
Balance	$138,679.77

THE NORTHERN STATES POWER COMPANY reports an increase of 17.4 per cent in gross, and 20.1 per cent in net over July a year ago:

Month of July	1916	1915	Increase	% Inc.
Gross Earnings	$ 434,362	$ 369,903	$ 64,459	17.4
Net Earnings	230,448	191,889	38,559	20.1
Year ended July 31				
Net Earnings	3,170,736	2,661,255	509,481	19.1
Gross Earnings	5,678,067	4,807,594	870,473	18.1

THE STANDARD GAS & ELECTRIC COMPANY has declared a quarterly dividend of 1 per cent on the preferred stock of the company, for the quarter ending August 31, 1916, payable September 15 to stockholders of record August 31.

THE ARKANSAS VALLEY RAILWAY, LIGHT & POWER COMPANY has declared a regular quarterly dividend of 1¾ per cent on the preferred stock, for the quarter ending August 31, payable Sept. 15 to stockholders of record August 31.

THE HAVANA ELECTRIC RAILWAY, LIGHT & POWER COMPANY reports for July gross, $492,520; increase, $44,015; net, $313,466; increase, $37,552; surplus, $182,045; increase, $13,464.

THE MUSKOGEE GAS & ELECTRIC COMPANY has declared a regular quarterly dividend of 1¾ per cent on the preferred stock of the company, payable September 15 to stockholders of record August 31, 1916.

H. M. BYLLESBY & COMPANY reports, on their utility properties combined gross and net earnings as follows, for the month of July and the twelve months ended July 31:

Month of July	1916	1915	Increase	% Inc.
Gross Earnings	$1,243,469	$1,126,171	$117,298	10.4
Net Earnings	578,564	513,421	65,143	12.6
Year ended July 31				
Gross Earnings	16,412,807	15,078,929	1,333,878	8.8
Net Earnings	8,095,572	7,268,104	827,468	11.3

Current Prices of Public Utility Securities.

	Bid	Asked
Adirondack Elec. P.	26	28
Adirondack Elec. P. pf.	78	81
American Gas	120	123
*American Gas & Electric	153	156
*American Gas & Electric pf.	49	51
American Light & Traction	380	384
American Light & Traction pf.	109	111
American Power & Light	70	71
American Power & Light pf.	84	86
American Public Utilities	42	47
American Public Utilities pf.	73	76
Amer. Water W. & Elec.	8	9
Amer. W. W. & E. part'g pf.	20	23
Amer. W. W. & E. 1st pf.	61	65
Carolina Pow. & Lt.	27	30
Carolina Pow & Lt. pf.	97	100
Cities Service	280	284
Cities Service pf.	87½	88½
Colorado Power	24½	26½
Colorado Power pf.	99½	101½
Commonwealth, Pr. Ry. & Lt.	62	64
Commonwealth, Pr. Ry. & Lt. pf.	83	85
Denver Gas & Electric gen 5s.	96¾	97¾
Electric Bond & Share pf.	100	103
Empire District El. pf.	88½	92½
Federal Light & Traction	10	13
Federal Light & Traction pf.	45	48
Gas & Electric Securities	290	—
Gas & Electric Securities pf.	95	100
Northern States Power	86	87
Northern States Power pf.	96	97½
North Ont. Lt. & P.	15	18
North Ont. Lt. & P. pf.	60	65
Ozark Power & Water	43	46
Pacific Gas & Electric	58	58¼
Pacific Gas & Electric pf.	90	91½
Republic Ry. & Light Co.	36	38
Republic Ry. & Light Co. pf.	74	76
*Standard Gas & Electric	15	15½
*Standard Gas & Electric pf.	40	40½
So. Cal. Edison	90	93
So. Cal. Edison pf.	105	108
Tennessee Ry., Light & Power	10	12
Tennessee Ry., Light & Power pf.	48	50
Toledo Trac., Light & Power	42	44
Toledo Trac., Light & Power pf.	79	83
United Light & Railways	50	52
United Light & Railways 1st pf.	74	76
Western Power	19½	21
Western Power pf.	69½	71

*Par value $50